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AUTOMOTIVE INDUSTRIES

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SEPTEMBER 15, 1941

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3. The assembly is cup adjusted. (Either threads on the cup carrier or shims as shown in the illustration may be used). Thus, if the cups are too tight accurate adjustment cannot be made.
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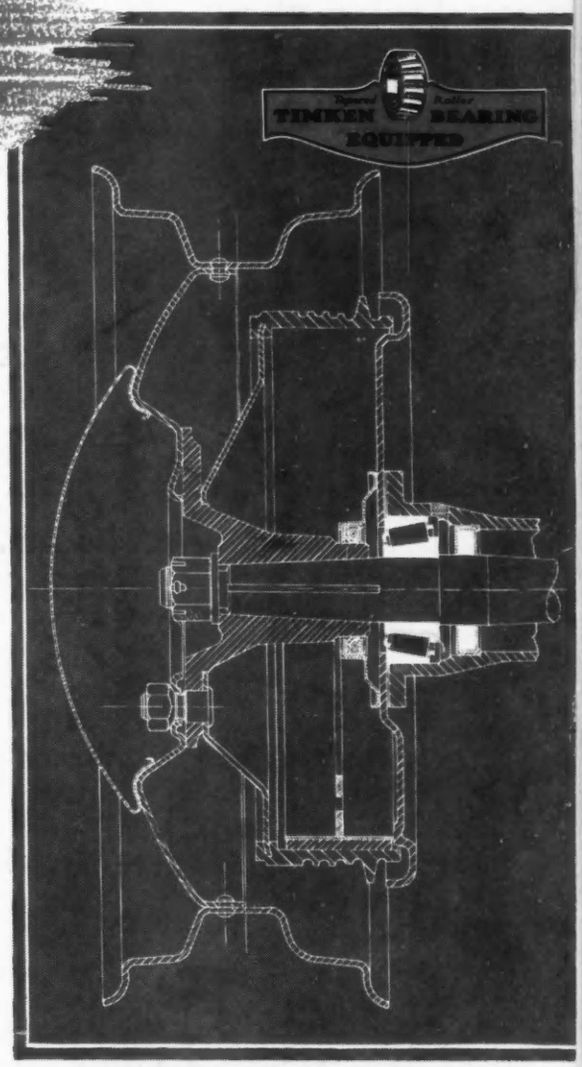

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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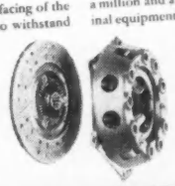

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IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 85 September 15, 1941 Number 6

Changes in Automobile Wiring System Standards

Certain changes have been made in Commercial Standards CS80-41 to CS86-41 inclusive, relating to lamps and signal equipment for vehicles. The changes were approved by the Standing Committee and adopted by the industry. They become effective September 15, 1941.

In each of the above-listed commercial standards the paragraph relating to the grade of wire to be used is to be changed to read as follows:

"All wire used shall be stranded copper conforming to SAE Standard specifications known as Type No. 2 or better, and shall have an electrical resistance not in excess of 4.71 ohms per 1000 feet at 68° F. or shall have a cross-sectional area of not less than 2361 circular mils."

In CS80-41 the following is added to the above paragraph: "—at least 60 feet per set."

In CS81-41 the same paragraph contains the following additional wording:

(*Turn to page* 50, *please*)

A MESSAGE

TO YOU . . .

Defense Savings Bonds and Stamps give us all a way to take a direct part in building the defenses of our country—an American way to find the billions needed for National Defense.

The United States is today, as it has always been, the best investment in the world. This is an opportunity for each citizen to buy a share in America.

STEEL—in America and in Britain **11**

The steel situation is of vital interest to this country and to England. Much of the success of the present war depends on the steady flow of this metal to the defense industries. Two parallel articles appear under this heading, one giving a most comprehensive picture of the situation in this country, and the other of the situation in Britain. They are written by two men who know.

Ideal Working Conditions and Modern Tooling **12**

The Aeroproducts Division of General Motors is doing a really big job in furthering the defense program. Situated in the Dayton suburbs and covering 193,000 sq. ft. of floor space, it has about everything to facilitate the movement of its products as well as the comfort and care of its workers. This article tells a very complete story of what has been accomplished and how.

Fuel Injection for Aircraft Engines **18**

Our engineering editor, P. M. Heldt, has done himself proud in this treatise on fuel injection. The different methods in practice are each discussed and classified for their proper places in practical use.

Messerschmitt 109 F Warplane **22**

Much interest has been shown in these German planes and here, in picture and text are the details of a model that has been so much in the news.

Laboratory Tests Guard Muskegon Quality **26**

Piston rings are somewhat out of the picture for many production men and just how they are produced and how their high quality is maintained at the Muskegon plant is told by Joseph Geschelin. You will find a number of new features in production here, so make it a "must read."

Ersatz Fuels Test French Ingenuity **32**

The scarcity of gasoline and the diversion of what there is to military needs has brought about a situation that was hard to beat. What the French people are doing to meet their needs is told in pictures with enlightening captions.

● Ninety-nine years means very little! Ninety-nine years of highly specialized experience in the steel business means a great deal; especially when that experience has involved handling huge quantities of steel, in thousands of kinds, shapes and sizes, and serving the varied needs of a host of users in every industry.

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We are glad to be 99! We are grateful for the past loyalty of our customers — but more grateful, perhaps, for their cooperation now, in our effort to serve them to the full limit of our resources. Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 85, No. 6
September 15, 1941

Steel in America and in Britain

Adequate Supplies Reported Available in Both Countries; American Metals Specialist and Automotive Industries' London Correspondent Stress Reports of American Iron & Steel Institute and British Iron & Steel Control Board

America

By W. C. Hirsch

THE AMERICAN IRON & STEEL INSTITUTE has made public the results of a study of its Committee on Commercial Research, forecasting total requirements of 80,000,000 net tons for defense, domestic civilian use and for export in 1941. The industry's ingot capacity, as of June 30, was rated at 86,148,700 net tons. The study was based on records of actual shipments to major industries and estimates of expected demand, computed chiefly on the basis of takings of customers in the first quarter of this year. The Institute's estimate forecasts the need of 11,000,000 tons of steel in 1941 by manufacturers of automobiles, motor trucks and motorized military equipment, excluding tanks.

Government diversion of the tonnage allotted in the Institute's estimate to some consuming categories may, of course, alter the distribution breakdown, but there appears to be general industry acceptance of the steel

(*Turn to page* 50, *please*)

Britain

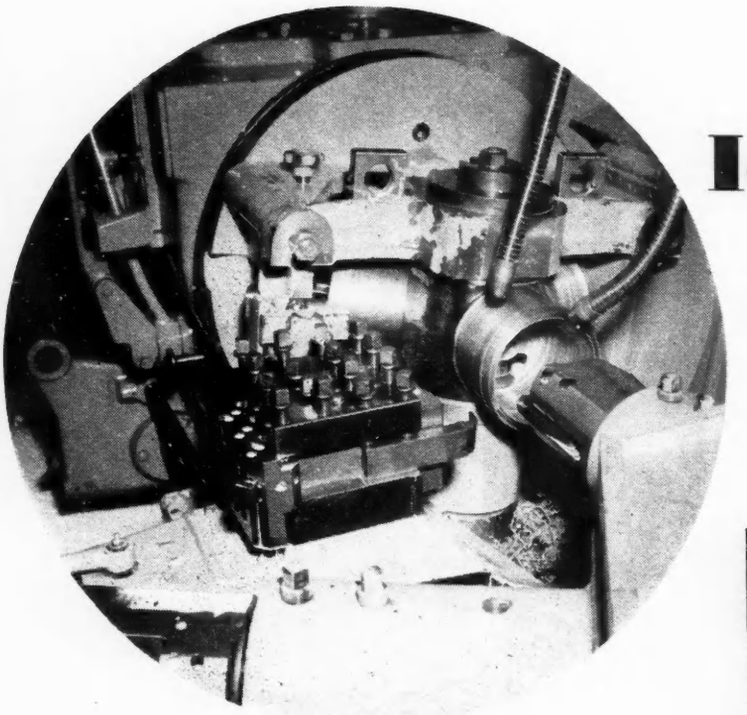
By M. W. Bourdon

IN A review of the results of its activities since it was established at the outbreak of war, the British Iron & Steel Control Board states that Britain is now in the gratifying position of being able to meet all demands for raw steel. And that in consequence of the steps taken throughout the war to control the supply of raw materials for steel manufacture and to restrict non-essential steel consumption, the country is now much less dependent upon imports.

This concentration of the whole of the nation's steel output upon supplying the requirements of the war machine—guns, ships, airplanes, tanks and other munitions—apart from a relatively insignificant quantity for civil uses, is described as a revolution in production and distribution. So successful has this policy been, it is stated, that in order to avoid unnecessary expenditure of energy, some sections of the industry will be able to close down for the duration of the war,

(*Turn to page* 50, *please*)

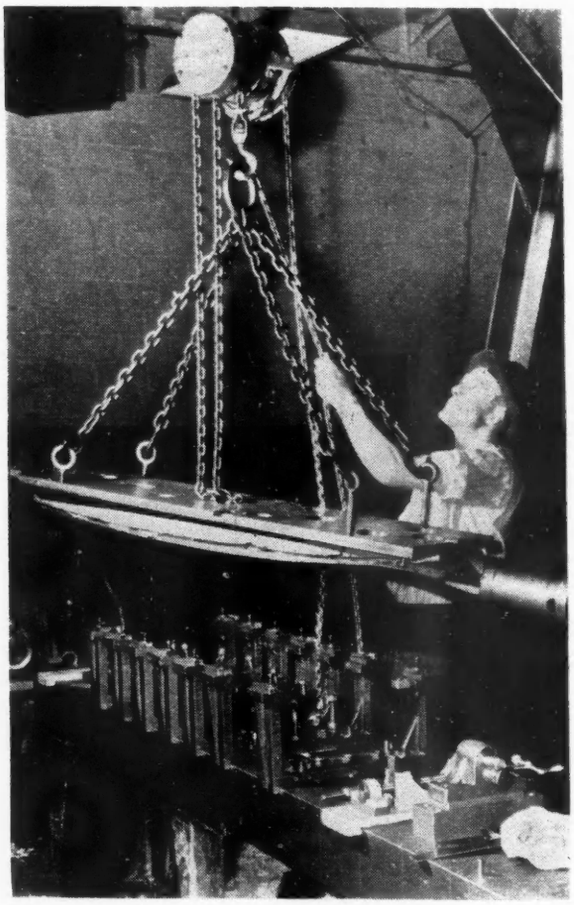
AVIATION INDUSTRIES



Ideal Working

(Circle) Close-up of one of the Warner & Swasey operations—boring the socket. Note the detail of the indexing fixture employed for this purpose.

(Below) Due to the need for protecting the alignment of the slender blade assembly during the course of machining and heat treating operations, the unit is handled in massive matrix fixtures such as the one shown in this view.



WITHIN the short space of about a year, the Aeroproducts Division of General Motors Corp. has been housed in a modern plant of 193,000 sq. ft. of floor space, just outside of Dayton, Ohio, directly across the road from the Municipal Airport and is working on a three shift, six-day basis on the manufacture of a line of hydraulically operated variable-pitch propellers for airplanes. At the present writing, the plant has more than 800 employes engaged in trainee production, testing of propellers, and the installation of new equipment which is coming in at an accelerated pace.

Just a year ago, General Motors acquired the propeller business of Enginering Projects, Inc., an independent organization that had been working on the development of a hydraulic propeller. Under the impetus of the emergency this new principle has been translated into a production reality, the first propeller having been approved by the Army several months ago. Doubtless this new principle in automatic propeller design appealed to th G. M. management due to its kinship to the hydraulic system which has worked so successfully in the Hydra Matic transmission, pioneered by the corporation.

One of the major advantages of the Aeroproducts propeller design is the fact that all of the operating mechanism is housed either within the hub sockets or around the hub, thus leaving the center bore of the hub completely unrestricted. This makes it a natural for mounting on the Allison engine, with which a center-mounted cannon is sometimes used on fighting ships.

Aeroproducts propellers are so designed that engine speeds are held constant and variations in load requirements are met by automatic changing of the angles of the rotating blades. Minimum weight, accurate hydraulic regulations for the desired pitch, and the ability to attain a "full feathering" position (most useful in "braking" a propeller when an engine becomes disabled) are among the important advantages of this advanced propeller.

Another important feature of the hydraulic propeller is its mechanical simplicity and the relatively small number of component parts required for an assembly. We understand that although the original design had something over three hundred parts, the current models—there are five models in the test stage at the moment—have only 186 parts, of which 40 will be made by outside contractors.

The plant is a modern single-story building with

Conditions and Modern Tooling

are dominating features of the Aeroproducts plant of General Motors

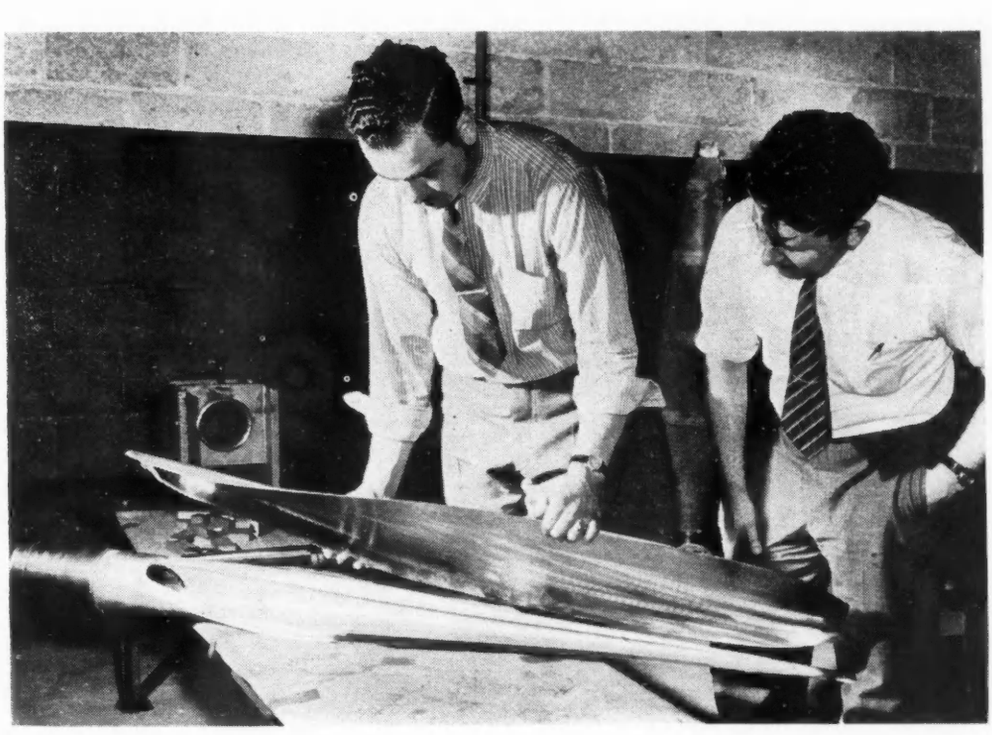
high ceilings, excellent lighting fostered by the installation of fluorescent light sources mounted at close intervals. The entire building is air-conditioned, the temperature being maintained at about 76 deg. F. However, the master gage department in which all tools and gages are inspected, is housed in an insulated room with its own conditioning system so as to hold the temperature at 68 deg. F. without variation.

From the standpoint of mechanical equipment, the plant has been provided with the finest machinery available in this country. An interesting feature of the plant layout is a self-contained model shop, equipped with the best of tool room machinery including a large Keller machine. This department is concerned with development work, with the manufacture of experimental propellers, and with the details of experimental production.

Among the items of equipment already in place and in operation, we may highspot the following—a battery of Warner & Swasey turret lathes, two big Keller machines holding three blade forgings in one setting, Gisholt turret lathes, a big Clearing hydraulic press, a number of Electric Furnace Co. heat treating furnaces, a complete polishing department equipped with Schmieg Centri-Merge booths, Baker drilling machines, a huge Thompson surface grinder, Cleveland planers, Cincinnati Hydro Tel milling machines of three-spindle type, Fellows gear shapers, and many others too numerous to mention.

The handling of large parts is expedited by an overhead monorail system which carries hoists for the lifting and transportation of these parts within a department. Interdepartmental transportation of raw materials and finished parts is handled by industrial trucks of various types supplied by Clark and several other makers.

In keeping with current practice, the power for operating machine tools is distributed by an overhead system of Bus-ducts. This centralizes the electric power supply, simplifies the problem of locating and shifting machines whenever it becomes necessary to move machines from one department to another. Another subtle but most important activity is the standardization of cutting fluids. For the most part, Aeroproducts has standardized upon a mixture of soluble oil for all metal cutting operations, thus simplifying the storing and distribution of cutting fluid, also



This shows the two-piece construction of the blade — the machined forging is resting on the table, while the sheet steel shroud is held by the operator.

affording complete control of this vital function.

During the preliminary period of experimental production, the company has established a comprehensive course of training not only for its machine workers but also for its other personnel. Regular lecture courses are in progress for groups of engineers, for foremen, and for the supervisory force which must have a first-hand knowledge of government specifications. The trainees for the machine shops are given a working knowledge of the equipment and specific tasks for which they are intended by actual practice on the night shift when there is a minimum of interruption of the regular production schedule.

At the present writing, the plant is fully equipped for the production of propeller blades and hubs, the components of the hydraulic control being made by a number of outside contractors. Equipment is now coming in at a fast rate and will permit the setting up of departments for other major components such as gears, sleeves, etc. However, even when the plant is fully under way, at least 40 different parts will continue to be made by sub-contractors.

The hub forging is made as a solid piece weighing 250 lb. at the present time. However, Wyman-Gordon is now experimenting with a procedure in which the blade sockets will be extruded from the central forging, thus reducing the weight of the rough forging and eliminating much of the metal removal by providing cupped out sockets. When this procedure is in effect, the hub forging will be delivered sand-blasted and free from scale, heat treated to a hardness of R_c 32.

The routing given below is based upon the machining of the extruded forging, outlines the advanced procedure rather than the temporary line-up now in effect.

Rough drill cross bore
Baker vertical drill
Rough drill 3 sockets
Baker horizontal drill
First W & S chucking, rough bore front
Warner & Swasey turret lathe
Second W & S chucking, rough bore rear
Warner & Swasey turret lathe
Third W & S chucking, rough bore 3 sockets
Warner & Swasey turret lathe
Fourth W & S chucking, finish broached portion and finish turn O.D. on rear
Warner & Swasey turret lathe
Rough and finish broach spline
American broach
Face rear and 3 locating pads
Monarch lathe
Fifth W & S chucking, finish turn and bore the rear end
Warner & Swasey turret lathe
Sixth W & S chucking, finish turn and bore the front end
Warner & Swasey turret lathe
Seventh W & S chucking, finish turn and bore the 3 sockets
Warner & Swasey turret lathe
Duplicate the outside
Cincinnati Hydro-Tel
Broach slots on socket ends
American broach
Drill 3 holes and tap for ⅛ in. pipe
Drill press
Drill and counterbore 6 holes in rear face
Drill press
Drill and ream 2 holes in each 3 sockets
Burr all holes and wash
Tank
Hand grind, polish, burr and balance
Inspect

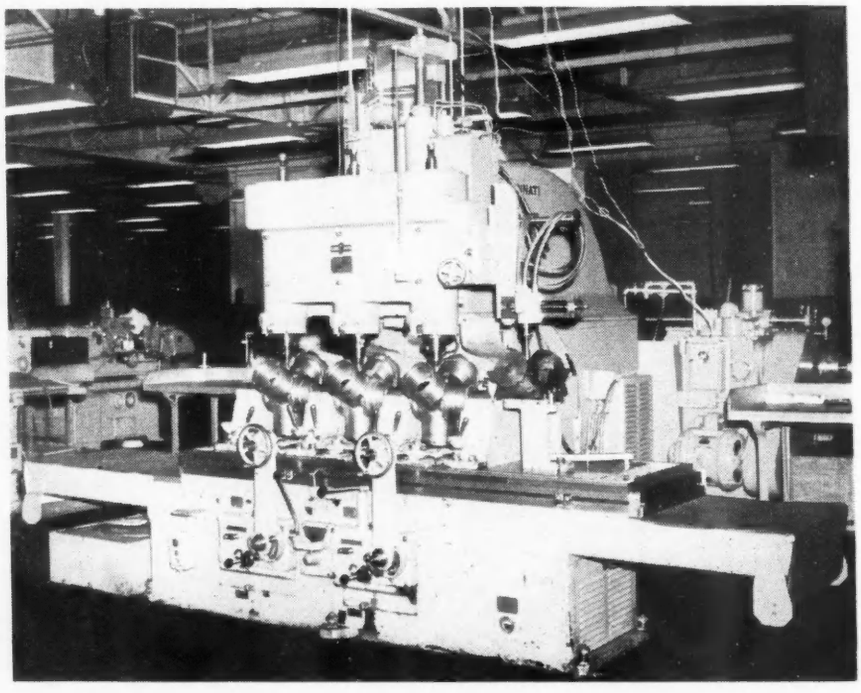
It is of interest to note that the outside contour of the hub forging is finished to the proper form and wall thickness on a three-spindle Cincinnati Hydro-Tel milling machine, using a master form for the operation.

At the present moment, the hub forging weighs 250 lb. and is machined down to 50 lb., a ratio of five to one. It is made of SAE X4340 alloy steel. After machining, the hub forging is given a heat treatment, consisting of heating to 1525 deg. F. in an Electric Furnace unit, then quenching in oil, and finally drawing at 1100 deg. F.

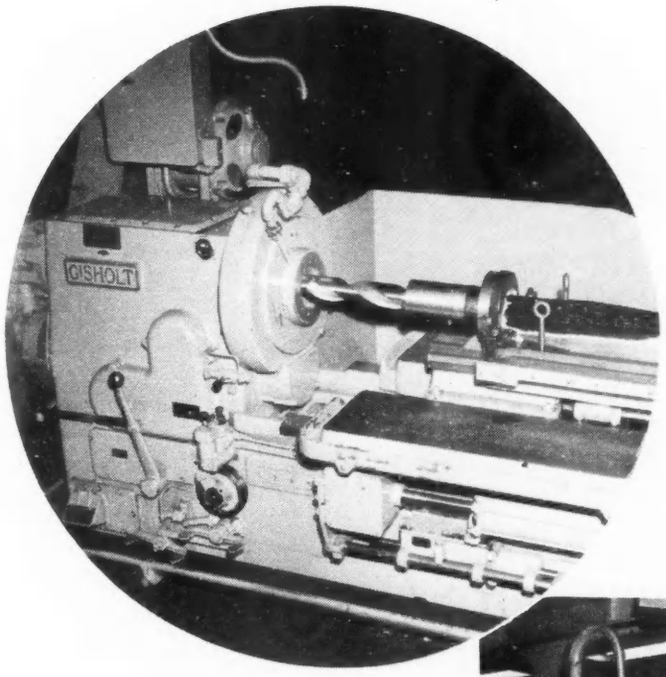
As an example of the precision machining problem, it may be noted that the bore of the hub is held to a diameter of 6.750 in. plus 0.001 in. minus 0.000 in. for a length of three inches.

The steel propeller blade—or thrust member, as it is called—starts as a steel forging, made of SAE 4640 alloy steel, weighing 200 lb. in the rough and machined down to but 50 lb. The routing listed below gives the sequence of operations in the machine shop.

Inspect
Cutoff coupon
Saw
Center ½ in. both ends
Sundstrand milling machine
Contour tip and edges
Sundstrand milling machine
Locate blade in fixture flat side up
1st Gisholt operation, rough drill, turn, face, and relieve
Gisholt lathe
2nd Gisholt operation, rough cavity except dome, chamfer and face
Gisholt lathe
3rd Gisholt operation, finish turn and dome
Gisholt lathe
Finish back of shoulder and recess on O.D.
4th Gisholt operation, finish bore cavity (except dome)
Gisholt lathe

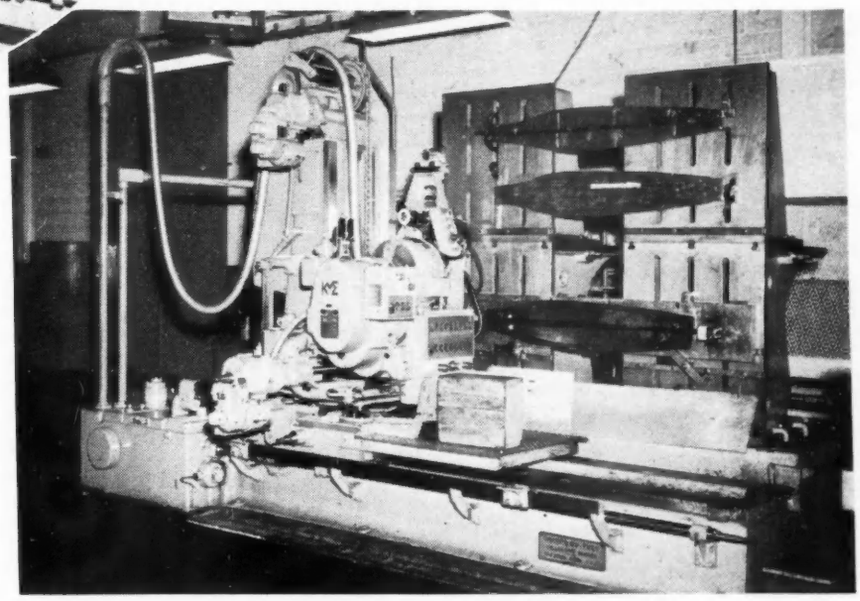


Big Cincinnati Hydro-Tel milling machine fitted with an automatic tracer attachment roughs out the outer contours of the hub forging, taking three parts at a time. Note the master form and tracer arm at the right.



Following the routing note, first, the sequence of four operations on Gisholt turret lathes. It is a matter of real interest to find that the contouring of the plane side of the blade forging is done on a Cleveland planer fitted with an automatic tracer attachment which follows a master pattern. This produces a surface sufficiently smooth and accurate so that it can be polished to the desired finish either on the big Thompson surface grinder or by hand grinders in the polishing room.

The camber side, too, is finished on a Cleveland planer, to a master pattern, in preparation for the camber sheet. The cavities in the camber side of the blade are formed according to a master pattern on Cincinnati Hydro-Tel machines as well as the Keller machines which take three blade forgings at a time.



(Circle) Here is one of a battery of Gisholt lathes on the thrust member machine line. Note that the blade is held in one of the massive matrix fixtures to prevent misalignment or distortion of the slender forging.

(Right) One of the two Pratt & Whitney Keller machines in the blade department, takes three blades at a time, forms the cavities in the camber side. A smaller Keller is installed in the model shop.

Duplicate the flat side
Cleveland planer
Grind the flat side
Thompson Hydro-Matic grinder
Locate blade in fixture camber side up
Duplicate the camber side
Cleveland planer
Duplicate the cavities
Cincinnati Hydro-Tel
Grind the camber side
Thompson Hydro-Matic grinder
Mill groove for brazing rod
Cincinnati mill
Grind relief and dome on inside of root end
Heald internal grinder
Drill locating hole and slot tip
Rough grind and balance
Gisholt lathe
Inspect
Magnaflux and demagnetize
Clean and apply stopoff
Chrome plate
Strip stopoff
Inspect

In the final form the camber side of the blade is sheathed with a steel stamping which is permanently brazed to the forging.

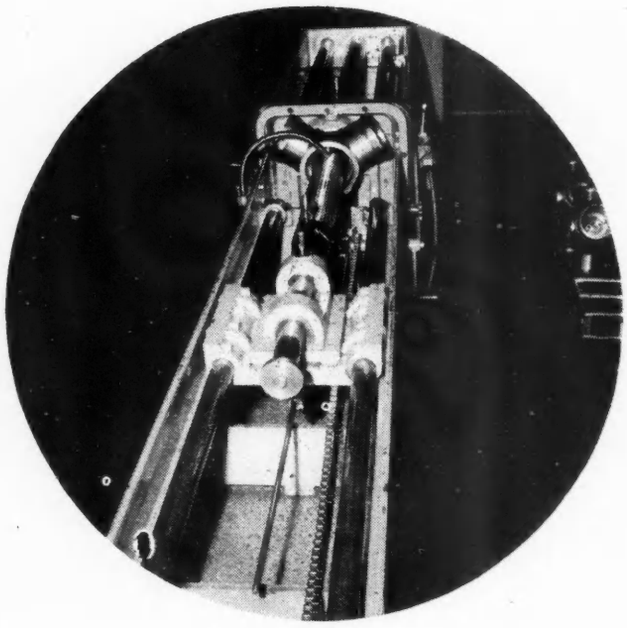
The grinding operation on the Heald is rather interesting, principally because the work-head fixture is of adequate size and rigidity to support the entire blade. The illustration of this operation shows how the blade is arranged to enter the fixture from the outside, shrouded to protect the operator.

Upon completion of the machining of the blade, there follows the brazing of the steel stamped camber sheet to the blade. An assembly consists of one blade, one camber sheet, and a balance cup ring. The operations to this end are given in detail below.

Fit the camber sheet to thrust member
Assemble balance cup ring
Inspect
Assemble and swage brazing wire into center rib
Tackweld camber sheet to thrust member
Cut and lay brazing wire around edge to be welded
Preheat, braze, and cool in furnace
Test for leaks and clean
Harden and quench
Clearing hydraulic press
Degrease and draw
Strip chrome and clean

Magnaflux
Finish turn, face, and form
Warner & Swasey turret lathe
Contour complete
Cut off tip and fit to templates
Grind by hand and balance
Spray inside with rustproof
Assemble cup and final balance
Grind I.D. and O.D. on root end
Heald internal grinder
Drill dowel holes
Mill threads
Lees-Bradner thread mill
Burr edges on threads
Inspect and etch

Looking down on the huge American broaching machine for rough and finish-broaching the spline through the center bore.



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Assemble 6 tubes, solder and sweat
Pressure inspection
Grind I.D. and O.D. on rear, and face
72A3 Heald grinder
Grind I.D. on front, and face
72A3 Heald grinder
Finish grind the 3 sockets
No. 74 Heald grinder
Drill, chamfer, and tap (12) ¼—28 undersize holes in front face. Finish tap by hand
Drill press tapper
Drill 6 holes in each 3 socket bosses
Rose ream (3) ⅜-in. hole in 3 socket bosses
Rough and finish tap by hand (3) ⅜—20 NS in 3 socket bosses
Cut 6-in. internal threads in 3 sockets
Lees-Bradner thread mill
Cut 5.900-in. thread on rear end
Lees-Bradner thread mill

Semi-finish 15 deg. cone, blue, and finish grind
No. 74 Heald grinder
Semi-finish 30 deg. cone, blue, and finish grind
No. 74 Heald grinder
Inspect
Final balance
Sand blast
Cadmium plate
Inspect and etch

The propeller testing tunnels and laboratory, located in a separate building on the premises, are equipped for testing liquid-cooled as well as air-cooled aircraft engine installations. At the present time, there are two test cells but it is anticipated that two additional tunnels will be added shortly. The testing procedure consists of three different types of test schedules.

First of these is the necessity of withstanding the strain of running 100 hours at full throttle, powered by an airplane motor. Second is the functional test in which the propeller is subjected to 2000 cycles of speed variations and 500 cycles of power variations.

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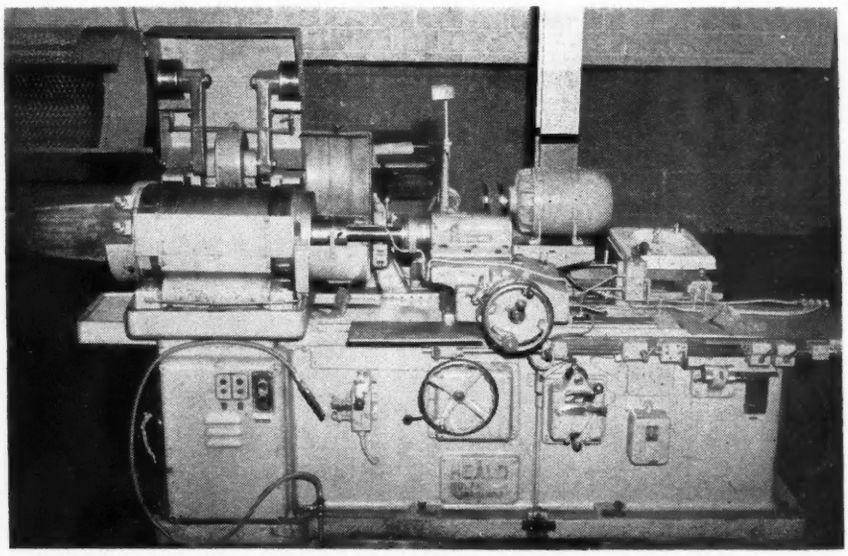
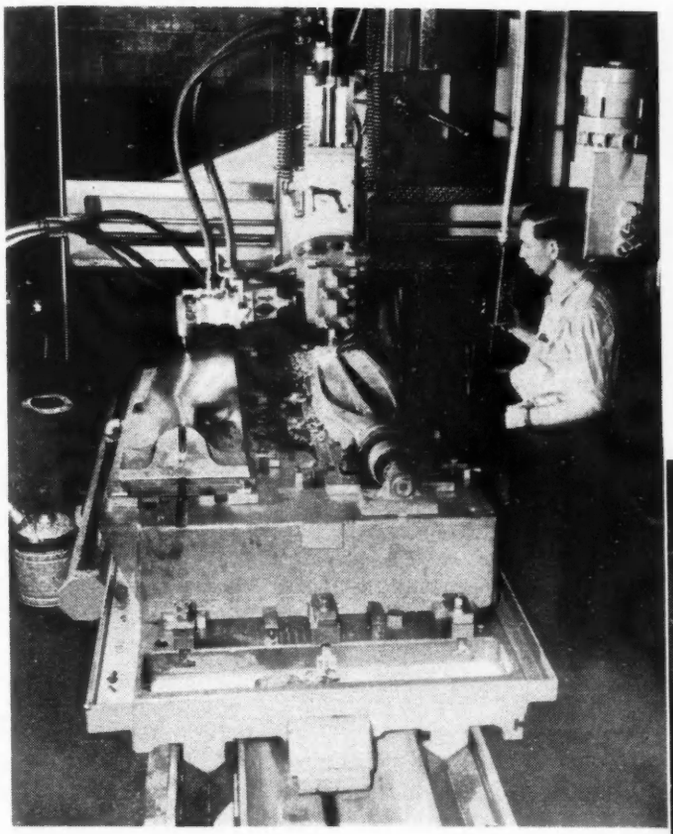


Grinding the relief and doming on the inside of the root end of a thrust member assembly on this No. 74 Heald internal grinder. The entire blade assembly is swung in the massive work-holding fixture at the left, the projecting end of the blade being protected by the safety screen.



(Above) One of a battery of new Cleveland shapers with tracer attachment, used for roughing and semi-finishing of the camber and plane sides of the propeller blade forging. It is of interest to learn that the planer does a job of finishing from the rough that requires but little touching up on a grinder or hand polisher to make an acceptable finish.

(Right) One of a battery of the big 61-A Fellows gear shapers used for cutting the special gears for the propeller control mechanism.

are checked by actually measuring the stress due to vibration. Prior to 1934, these strains were largely responsible for airplane propeller failures, which were attributed to "unknown causes." These measurements of vibration stresses are made at all speeds throughout the operating range of the propeller of each type of installation.

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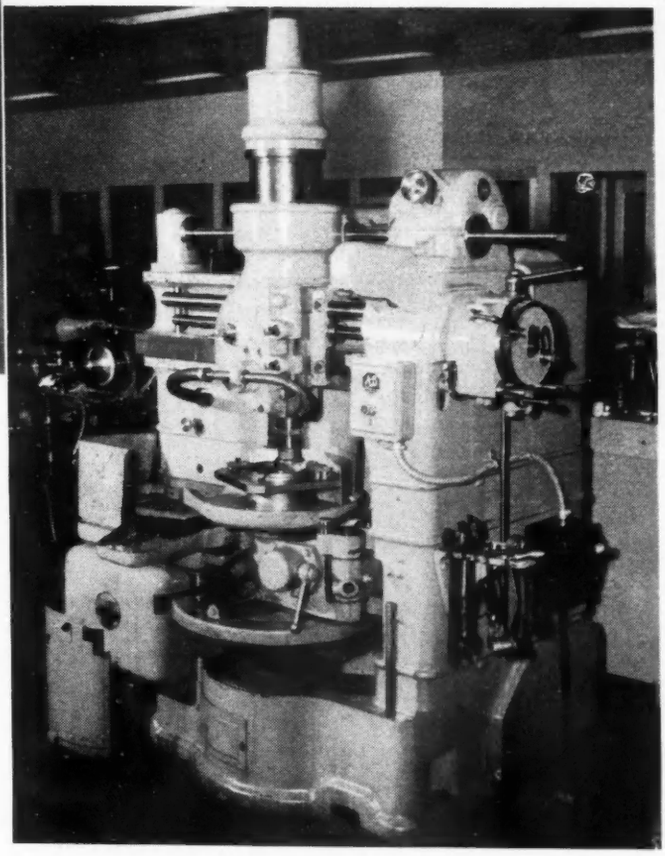

Improving the Piezo-Electric Pressure Element

THE so-called piezo-electric type of engine indicator is generally regarded as least influenced by inertia effects, yet users of such instruments who have been taking indicator diagrams under conditions of detonation are not satisfied with the results and demand instruments of higher natural frequencies. Writing in the VDI Zeitschrift, W. Kohlke states that commercial instruments of this type have resonance peaks below 6000 cycles per second, which makes it impossible to produce true records of phenomena transpiring in less than one-thousandth of a second. He made a study of the vibration characteristics of quartz blocks by subjecting them to what may be described as a reverse piezo-electric effect, that is, by applying high-frequency electric potentials to the faces of the blocks and recording the mechanical effects. He reports that, by making use of the results of this study, the Institute for Engine Research at the Aeronautic Research Laboratory in Brunswick has been able to develop a pressure element for an engine indicator of the piezo-electric type which fits into a 14-mm. spark-plug hole and has a frequency of 40,000 cycles per second. This pressure element is water cooled. For observations on pressure bombs, etc., where only a single pressure cycle has to be recorded, the water cooling can be omitted, and the natural frequency then can be raised to 60,000 cycles per second.

Magnaflux
Finish turn, face, and form
Warner & Swasey turret lathe
Contour complete
Cut off tip and fit to templates
Grind by hand and balance
Spray inside with rustproof
Assemble cup and final balance
Grind I.D. and O.D. on root end
Heald internal grinder
Drill dowel holes
Mill threads
Lees-Bradner thread mill
Burr edges on threads
Inspect and etch

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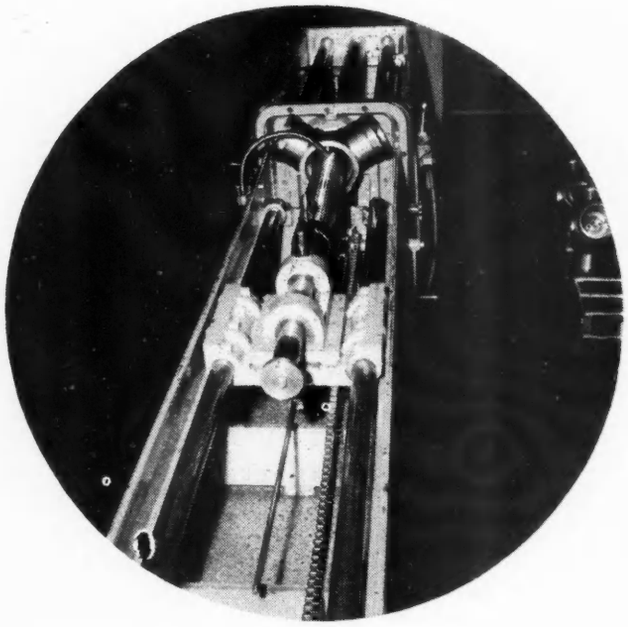

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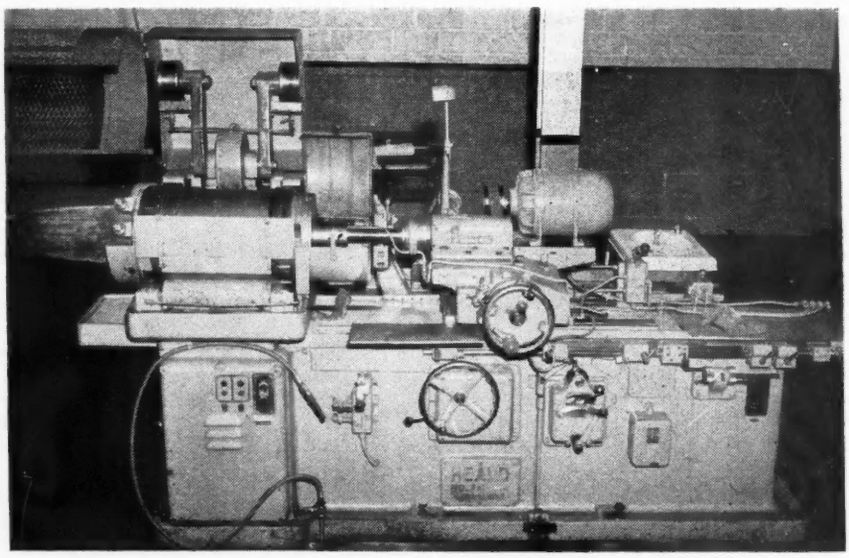

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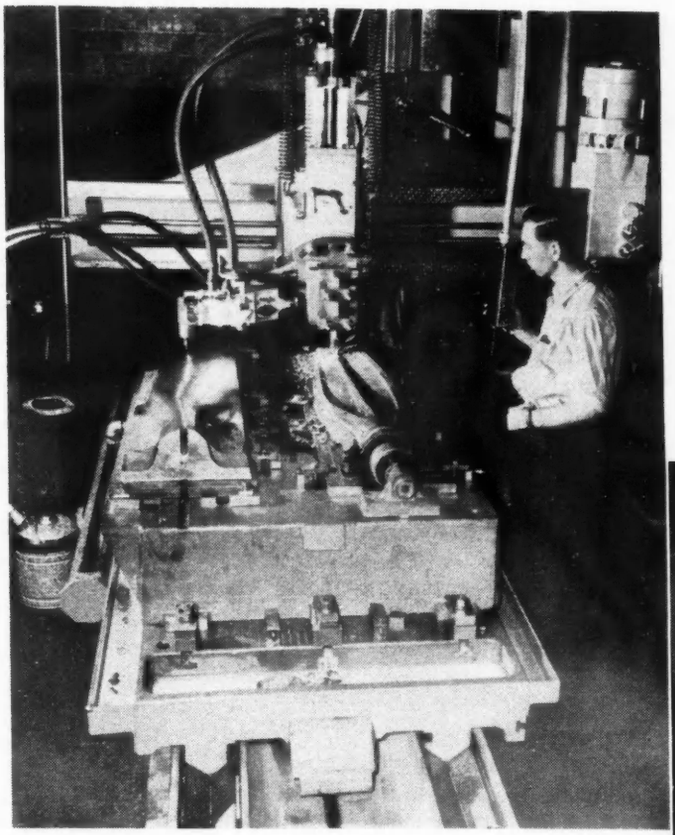

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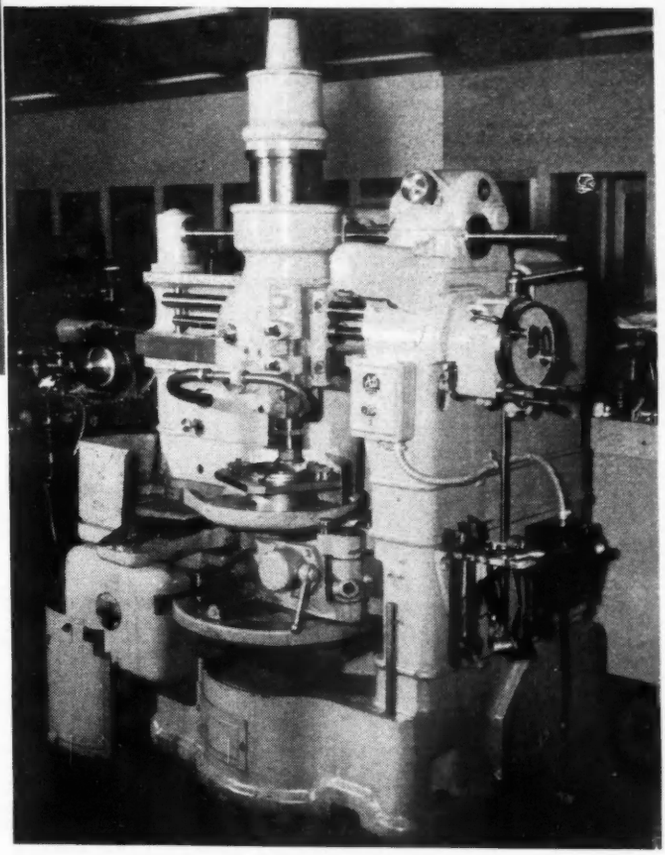

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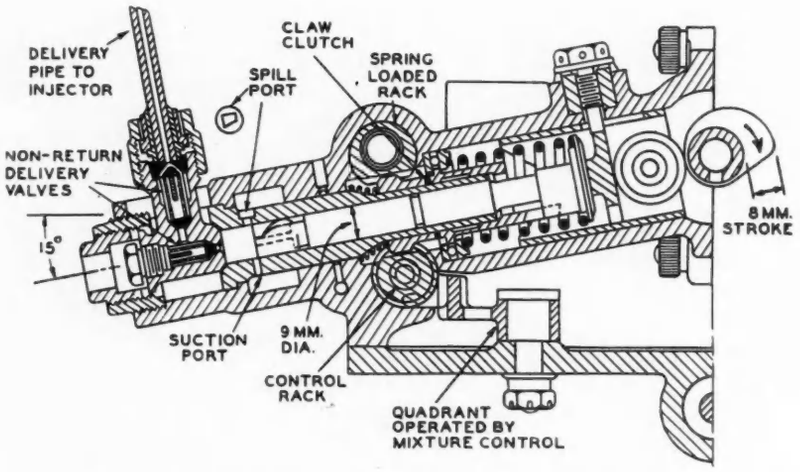
Fuel Injection

By P. M. HELDT

FUEL injection in aircraft engines appears to have been used first by the Junkers company during the World War, in a two-stroke horizontal engine. During the nineteen hundred twenties considerable development work on fuel-injection equipment was done in Germany, in connection with the development of high-speed Diesel engines, notably by the Bosch firm. During this period the Junkers company developed its Diesel-type aircraft engine, which naturally called for injection equipment. The 16-cylinder Diesel-type Daimler engines which powered the latest Zeppelins also had fuel injection. These two firms, Junkers and Daimler, are responsible for the principal engine types used by the German Air Force at present, both of which, while of the spark-ignition type, use fuel injection, a system with which their sponsors had become familiar through their experience with Diesel engines.



Injection pump of German spark-ignition aircraft engines (in section)

Fuel injection in a general way signifies the delivery into an air stream of liquid fuel under an absolute pressure higher than that in the carburetor air scoop. The fuel can be injected into a carburetor, into the manifold, or directly into the cylinders. Usually the term "fuel injection" is reserved for systems by which the fuel is injected either directly into the cylinders, as in Diesel engines, or into the inlet manifold immediately ahead of the inlet valve. In that case, of course, a separate injection nozzle is required for each cylinder of the engine, and unequal distribution due to separation of unvaporized fuel from the air stream is no problem. The Stromberg injector carburetor described in AUTOMOTIVE INDUSTRIES of June 15, is an example of fuel injection into the carburetor air tube.

Since the adoption by the Germans of fuel injection for aircraft engines operating on volatile fuel, there has been a good deal of discussion regarding the relative merits of carburetors and injection systems. One explanation as to why the Germans use fuel injection came from France during the early stages of the present war, and was to the effect that they did not know how to build a good aircraft carburetor and were compelled to resort to the next best thing—the injector. This explanation, however, is too simple to be entirely convincing. Both the carburetor and the injection system possess certain definite advantages which must be balanced against each other to arrive at a sound conclusion. It hardly needs to be pointed out that details of design are important and may throw the balance of advantage from one side to the other. A thorough investigation of the merits of fuel injection for aircraft engines was made by the National Advisory Committee for Aeronautics and was reported on by Oscar W. Schey.

It appears that fuel injection in aircraft engines is related to two other current developments in that field, viz., the use of safety fuels, and supercharging. Of these, the latter is now current practice so far as high performance, large-output engines are concerned, while the use of safety fuel is still in the experimental stage. Safety fuels are essentially petroleum fuels of low volatility which do not readily form an explosive mixture when spilled or when leaking from their containers. To atomize such fuels sufficiently finely to effect tolerably complete combustion, they must be sprayed under higher pressure than available suction heads, and that is where fuel injection comes in.

All of the high-output engines used in military planes are supercharged. To supercharge an engine, it must be provided with a blower, and when a blower is carried and the fuel is injected either directly into the combustion chamber or into the inlet tract immediately ahead of the inlet valve, it is possible to completely scavenge the combustion chamber of spent gases, thereby improving the cooling of thermally highly-stressed parts, such as exhaust valves and spark plugs, and at the same time increasing the engine out-

for Aircraft Engines

put. Scavenging of the combustion chamber calls for considerable overlap of inlet and exhaust periods. If the combustion chamber is completely scavenged, then the volume of air in the cylinder at the beginning of the compression stroke is equal to the combined volumes of the piston displacement and the compression chamber, whereas with atmospheric induction it is equal only to the displacement volume. When the amount of air taken in by the engine per cycle is increased, its volumetric efficiency is said to be increased.

There are two other factors which tend to increase the volumetric efficiency, and hence the output of the engine, with fuel injection. One is that, since the incoming air does not have to pass through a carburetor throat, the amount drawn in is not restricted by throttling or wire-drawing at the throat; the other, that the volume of the air on passing the inlet valve is not increased by the addition of fuel vapor, as in the case of a carburetor engine. This latter, however, is not an important factor, since the volume occupied by the gasoline vapor in a theoretically correct mixture is only about 1.6 per cent of the total. Schey reports having obtained a volumetric efficiency of 92.5 per cent with fuel injection and 86 per cent with a carburetor in the same engine at the same speed. There is good reason to assume that the power of the engine increases in direct proportion to the volumetric efficiency, and the above figures indicate a possible gain in power of 7.5 per cent.

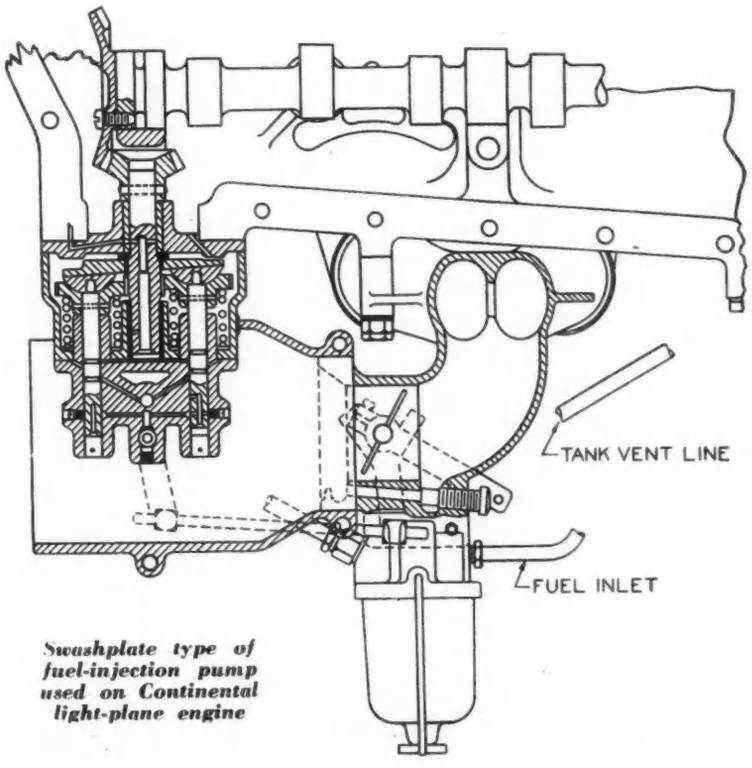
Another advantage of fuel injection results from more nearly uniform distribution when the fuel is sprayed directly into the cylinders. In tests on automobile engines it has been found that unequal distribution accounts for a loss in fuel economy of as much as 10 per cent, and presumably there is a similar loss in aircraft engines due to this cause. The carburetor must be so adjusted that the leanest cylinder will be sufficiently rich to fire consistently, and the remainder, or at least most of them, will then get too rich a mixture for most economical operation. The N.A.C.A. tests were conducted on single-cylinder engines and, therefore, did not throw any light on this subject, as no problems of distribution were involved.

Finally, the point is made that with fuel injection there is no possibility of icing the inlet tract, since the fuel is vaporized only within or at the entrance to the cylinder, where there is always sufficient heat available to keep the temperature well above freezing.

Injection equipment undoubtedly is somewhat more expensive than the carburetor which it displaces. The equipment required is really more complicated than that of a Diesel engine, in which latter the output is controlled by merely varying the fuel charge, the amount of air drawn in remaining substantially constand. In a spark-ignition engine the fuel and air charges should vary in the same proportion, and this undoubtedly calls for rather complicated control mechanism. If the mixture control is to be automatic it would seem that the control mechanism would have to be under the influence of both the depression in a venturi in the air intake line and of a capsule subjected to atmospheric pressure.

One problem that arises with fuel injection in engines using volatile fuel that is not encountered in Diesel engine is that of the lubrication of the injection pumps and injector nozzles. The gas oils used in high-speed Diesel engines have sufficient lubricating value to make special lubrication of these parts unnecessary, but gasoline has little or no lubricating value. In the N.A.C.A. tests the problem was solved by adding ½ per cent of light oil to the fuel, which did not measurably affect the output, the economy, and the anti-knock value of the fuel.

A number of questions arise when the fuel is to be injected directly into the



Swashplate type of fuel-injection pump used on Continental light-plane engine

combustion chamber; they concern the best timing and duration of injection and the best location of the injection nozzle in the combustion chamber. All aircraft engines using poppet valves are of the valve-in-head type. The single-cylinder engine experimented with by the N.A.C.A. had two exhaust and two inlet valves in the head, and with that engine the results were optimum when the fuel was injected laterally at a point midway between the two exhaust valves. About the only difference which can result from a change in the location of the injection nozzle is with respect to the distribution of the fuel particles in the air charge. This is generally improved by turbulence in the combustion chamber. With a conventional valve-in-head engine with plain valves, such as used by the N.A.C.A., the degree of turbulence is low, and it is surmised that with a high-turbulence engine the location of the injection valve might be of less importance.

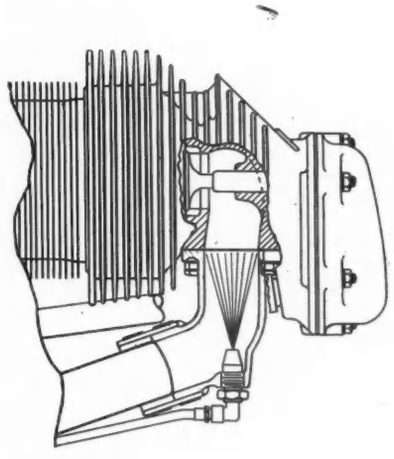
In spark-ignition engines with fuel injection, injection is effected during the inlet stroke, so as to allow sufficient time for vaporization and thorough intermingling of the fuel with the air. Evidently slight changes in the beginning or duration of injection are not nearly as important in this case as in the Diesel engine, where the beginning of injection determines the point of ignition. Although the turbulence, which affects intermingling of fuel and air, is greater at high engine speeds, earlier injection is advantageous at high speeds. This does not mean that injection timing must be variable so it can be changed when the speed of the engine varies, but merely that it is advantageous to set the beginning of injection earlier in a high-speed than in a low-speed engine. The N.A.C.A. obtained optimum results by starting injection 60 crank deg. after the beginning of the inlet stroke and having it extend over from 60 to 90 deg. of crank rotation. The fuel then enters the cylinder during the period when the rate of air flow into it is at a maximum and this would be expected to have the maximum distributing effect.

That the injection system has any advantages over the carburetor is categorically denied by a member of the Rolls-Royce technical staff writing in the British aircraft periodical *Flight* of March 6. The claims that fuel injection increases the fuel economy and improves altitude performance are disputed, and comparisons are made between the performances of two Junkers Jumo 211D engines removed from a captured Heinkel plane and tested at the Royal Aircraft Establishment, and the performance of the Rolls-Royce Merlin X engine. Both the German and the British engines are 12-cylinder, liquid-cooled engines fitted with two-speed superchargers and normally rated on 87-octane fuel.

The German engine is said to have 29.5 per cent greater piston displacement than the British and to use a compression ratio of 6.5, as compared with 6.0 for the Merlin, in spite of which its maximum power in both supercharger gears is said to be approximately 11 per cent less than that of the Merlin.

In comparative tests the two engines were operated at the same piston speed, and since the Rolls-Royce has a stroke of 6 and the Junkers a stroke of 6.5 in., this means that the Rolls-Royce was operated at a little more than 8 per cent higher rotative speed. The chart reproduced herewith shows by the full lines the fuel consumptions of the two engines under maximum economy conditions, in their dependence on the load. The fuel control was manually operated on both engines. It will be seen that the specific consumption of the Junkers is slightly lower than that of the Rolls-Royce throughout the range. However, it is pointed out that the Junkers operates with a compression ratio of 6.5, as compared with 6.0 for the Rolls-Royce, and if the compression ratio of the Rolls-Royce were raised to 6.5, then its consumption characteristic would drop to the values indicated by the dashed line. In that case the Junkers consumption figure would be better only at the lower end of the load range. For an aircraft engine a low power factor corresponds to low speed, and the advantage of the Junkers from the economy standpoint in the lower speed range is explained on the ground that the Rolls-Royce engine is designed for much higher operational speeds than the Junkers and the high-speed valve timing adopted probably is responsible for the difference. The article also included another chart for specific fuel consumptions, relating to the condition of automatic fuel settings, which showed the Merlin to have a materially lower consumption throughout the power range.

The other claims of superiority made for the injection system also were taken up by the Rolls-Royce technician one by one, and disputed. For instance, as regards the claim of superior altitude performance, while it is admitted that there is a slight pressure loss due to the restriction of the carburetor throat, of the order of 3 per cent, test results are said to show that engines with suction carburetor feed give a greater boost pressure than the corresponding gasoline-injection engines, despite the restriction of the carburetor throats.



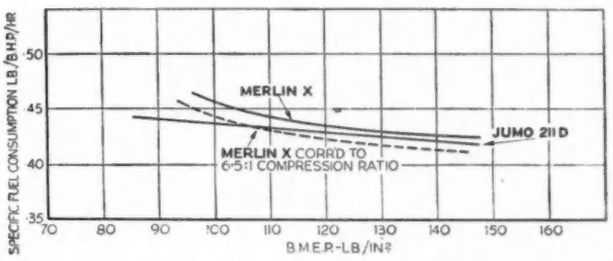
Method of mounting injector nozzle in Continental light - plane engine

Fuel injection requires equipment of considerably greater complexity than the carburetor. The total weight of the Junkers fuel system, including the fuel supply pump, is approximately 60 lb., while the Merlin carburetor including the Amal valve and fuel pipes, weighs only 25 lb. The Jumo injection system for the 12-cylinder engine comprises 1576 parts of 327 different designs, while the Merlin carburetor together with the Amal valve and fuel pipes has only 433 parts of

141 different designs. The opinion was expressed by the Rolls-Royce representative that the fuel-injection equipment might place a limit on the maximum operating speed of the engine, for it involves a mechanism similar to that of a valve tappet, the plungers being lifted by a cam and returned by a spring, and it is quite probable that at high speeds the plunger does not follow the cam accurately. It is mentioned in this connection that the diving speed of the Jumo 211D is limited to 2400 r.p.m., whereas the Merlin is cleared for 3600 r.p.m. Owing to the far greater number of parts in the fuel injection system and the high-class workmanship required by at least some of them, it is estimated that the cost of the injection system would be from six to eight times that of an equivalent carburetor. Service of the injection equipment would require skilled personnel and special equipment, and could hardly be undertaken in the field.

The claim that lower grade fuels can be used with injection systems is not borne out by analysis of the fuel in the German plane, which showed it to be of higher octane number than that used by the British. The claim of freedom from carburetor icing when using injection is disposed of by the statement that with suitable heating there is no fundamental reason why carburetors cannot be made immune from freezing. Similarly, the advantage of freedom from fire hazards due to backfiring through the carburetor is discounted by the statement that the use of induction-pipe flame dampers obviates this risk on aircraft engines equipped with carburetors.

Summing up his arguments, the Rolls-Royce representative concludes that "nothing would be gained, at least on conventional types of engines, by the use of injection pumps, and the carburetor has the advantages of simplicity, relatively low cost, and ease of manufacture and maintenance."



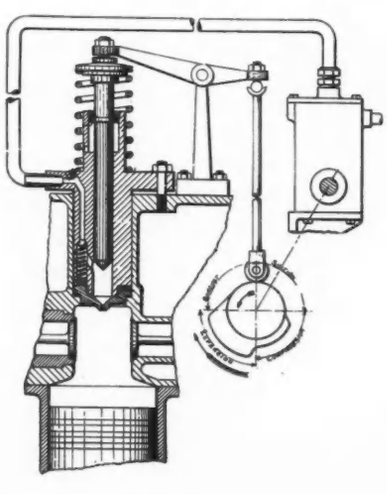
Specific fuel consumptions of Rolls-Royce Merlin X with carburetor and Junkers engine with fuel injection, under maximum economy conditions

* * *

Considering all of the items involved, it would seem that when both systems are at their best there is relatively little to choose between them. The rivalry between them has been a factor making for progress, in that the manufacturers of carburetors have made efforts to equal the performance of injection equipment, and manufacturers of injection equipment have been at pains to approach the simplicity and the low cost of production of the carburetor; or at least, if they have not done so already, they will be compelled to when emphasis shifts from military to commercial planes once more, in connection with which latter cost is a more important consideration.

Injection System for Compression-Ignition Engines

HENRY POKORNEY of Rome, N. Y., has developed an injection system for compression-ignition engines, of the type in which a fuel-air mixture is forced into the combustion chamber, instead of a solid jet of fuel. The arrangement is illustrated by the accompanying sectional drawing. Fuel is metered by a conventional fuel pump, and is delivered under low pressure into a fuel chamber through a port which is controlled by plunger adapted to reciprocate in fuel chamber. In the drawing the engine is shown at the beginning of the suction stroke, the plunger being in its topmost position. After from 5 to 7 deg. of crankshaft rotation from this point, the pump begins to deliver fuel through a check valve into the fuel chamber. Delivery into the fuel chamber is completed at about the end of the suction stroke, and the check valve in the fuel line is then closed by its spring. As the compression stroke begins, the cam causes the plunger to move down in the fuel chamber until the inlet port is closed, and the plunger remains in this position until the compression stroke is substantially completed. During the compression stroke air is being forced from the cylinder into the fuel chamber and mixes with the fuel and gaseous contents therein. At the beginning of the power stroke, the plunger is forced down to within about 0.010 in. of the bottom of the chamber, thereby forcing the combustible mixture into the cylinder, where it is ignited by the heat of compression.

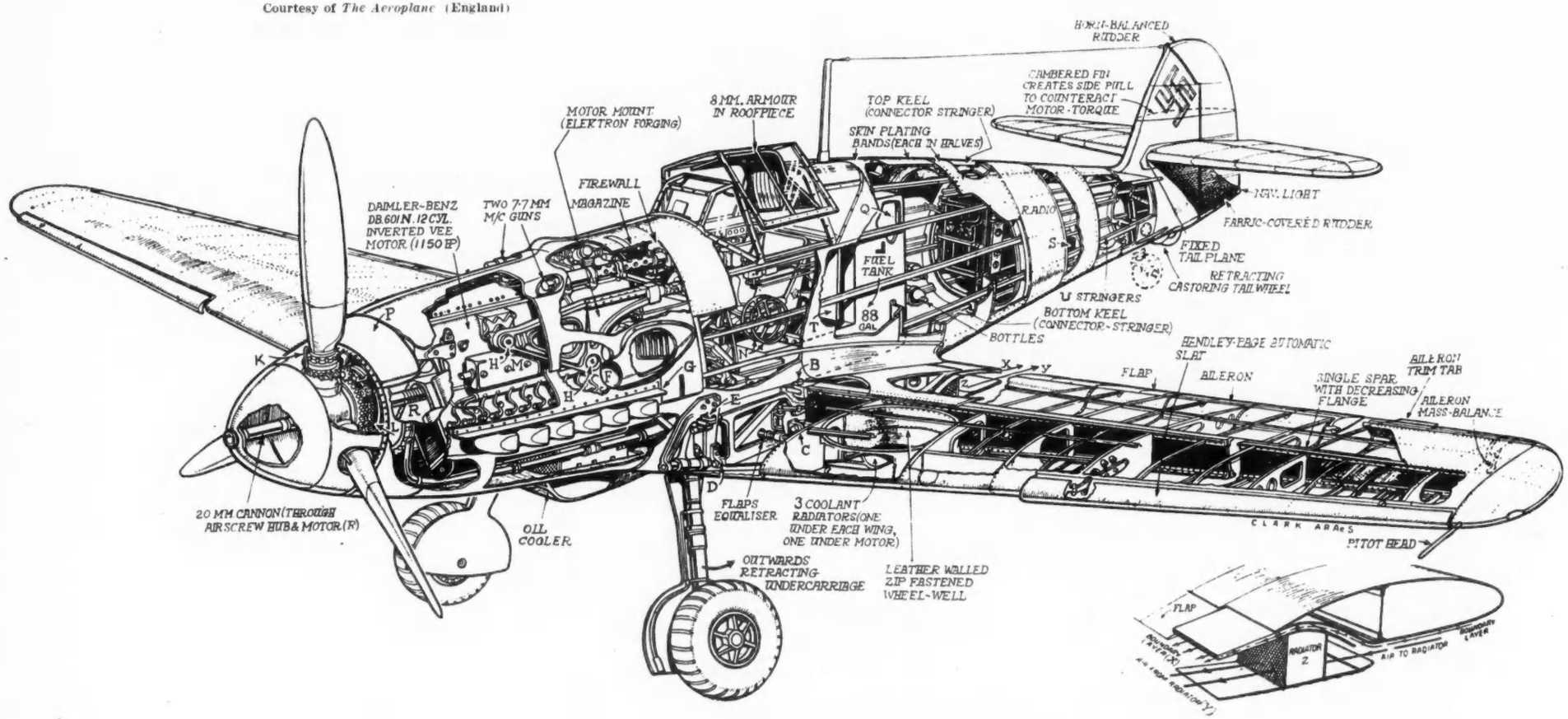


Mr. Pokorney has applied this injector to a single-cylinder experimental engine of 4½ in. bore by 7 in. stroke. The plunger of the injector is of ⅜ in. diameter and has a stroke of ⅝ in., the effective injection stroke (from the bottom of the fuel port) being about 0.5 in. The chief advantage claimed for this system is that while the fuel in the delivery line is subjected to low pressure only, thorough atomization and dispersion in the air charge are ensured.

The Messerschmitt Me-109-Fl-Series 2

B & C. Vertical and horizontal pin joints for spar.
D. Horizontal pin for front fix of wing.
E. Undercarriage electric interlock.
F. Supercharger air inlet.
G. Ejector exhausts.
H. Rubber anti-vibration motor mount pads.
K. De-icing spray pipe.
L. VDM electrically-operated controllable-pitch and constant speed propeller.
M. Coolant header tank (each side).
N. Undercarriage hand (emergency) retracting gear.
P. Oil tank.
Q. "L" shaped fuel tank. (Rubber bag in plywood casing.)
R. Cannon between cylinder banks.
S. Master compass (repeats on dashboard).
T. 10 mm. armor behind pilot's seat.

Courtesy of *The Aeroplane* (England)



Messerschmitt 109F Warplane

THE MESSERSCHMITT ME-109F, believed to be Germany's newest fighter, succeeds the Messerschmitt Me-109E warplane and is replacing the latter in the Luftwaffe squadrons. A Me-109-F1-Series 2 was captured this summer in southeast England practically undamaged after a forced landing and since then the British Ministry of Aircraft Production has used it for investigation. A description of this new Messerschmitt version was published in a recent issue of *The Aeroplane*, British aeronautical magazine.

Major improvements over its predecessor consist of a modified wing design, constant speed controllable pitch propeller, cantilever tail unit, boundary layer ducting around the radiators, and most outstanding a new high speed Mauser cannon that fires through the hollow propeller hub. In general, they are intended to provide higher speeds and better maneuverability at greater heights in combination with increased fire power.

Engine The engine, a Mercedes Benz DB-601N, is said to be essentially the same as the DB 601A, which was described in the June 15 and July 15, 1941, issues of AUTOMOTIVE INDUSTRIES. By changing from concave to flat-topped pistons, the compression ratio is raised from 6.9 to 7.9, which results in about six per cent more power at all heights over the DB-601A. Top speed at 21,000 ft. is reported to be increased from 372 m.p.h. to 380 m.p.h. and the ceiling from 36,000 ft. to 40,000 ft.

To obtain better flow conditions, the air intake to the supercharger is enlarged and set farther from the fuselage. The ejector exhausts have been modified to point almost straight backward. Changing of the engine is easier due to the new location of the oil tank, which has been removed from behind the engine to the position on top of the reduction gear formerly occupied by the glycol header tank, now made in two parts with one on each side of the crankcase.

Propeller The VDM propeller of three blades operates in connection with a constant speed governor mounted in the Vee of the engine cylinder block. The propeller also has a cut-out so that it can be used as fixed pitch type or hand-controlled for normal cruising. The spinner, which is larger and improved in shape, is hollow to accommodate the muzzle of the Mauser cannon.

Wing The flush-riveted wing now has rounded tips, which increases the total span by nine inches to 33 ft. with a gross wing area of 186 sq. ft. as compared with 176.5 sq. ft. for the former rectangular-tipped wing. Less drag is attributed to reduced thickness and modified section of the wing. Drag also is reduced by mounting the radiators deeper in the wings so that they do not project as far underneath the surface. They are located as previously in the trailing edge of the wing roots. Efficient cooling is assured by an arrangement of boundary layer ducts over the radiators and a combination of flaps, the movement of which is controlled thermostatically in two positions.

The wing is wired to carry a 550-lb. bomb slung externally between the wheels.

Fuselage Few changes have been made in the fuselage structure. The fuel tank, which holds approximately 88 Imperial or 106 U. S. gal., consists of a rubber bag in an L-shaped plywood box behind and under the pilot. Provision also is made for an extra fuel tank in a bomb rack under the fuselage. The 10 mm. armor plate has been moved ahead of the tank from behind it.

Located in the rear of the fuselage is a master compass connected to a repeater dial on the dashboard, which is the blind flying type and is sprung independently. Equipment includes a new type of high pressure oxygen apparatus for high altitude fighting.

Tail Replacing the braced and adjustable stabilizer is a fixed cantilever unit. There are no rimming tabs, but small adjusting tabs on the elevators can be set on the ground. Two internal and two external narrow longitudinal plates for the new stabilizer also strengthen the fuselage. The tail wheel has been made semi-retractable with half the tire projecting.

Armament Of most interest to the British is the new Mauser aircraft cannon, which has a high rate of fire of 900 rounds per minute, or 10 times greater than earlier German cannon of the same size. It is made in two sizes, 15 mm. and 20 mm., the latter being used on the Me-109-F1 and the former on the Me-109-F2. These Mauser cannons are electrically cocked and fired, and belt fed from the ammunition box in the starboard wing. In addition to the 20 mm. Mauser cannon, the Me-109-F1 has two 7.92 mm. Rheinmetal-Borsig machine guns, with 200 rounds for the cannon and 500 rounds for each of the machine guns. The Mauser cannon is mounted in the inverted Vee of the engine.

On the Me-109E the armament consists of two 20 mm. Oerliken wing cannons and two machine guns. The hollow propeller hub is used for cooling the

(*Turn to page 54, please*)

AVIATION INDUSTRIES

Airbriefs

By HENRY LOWE BROWNBACK

High Altitude Bombing

The near future will bring very high altitude bombing and this practice will tax the ingenuity of the makers of pursuit and interceptor planes. All of the advantage seems to be with the bomber at present as they can have sealed cabins and heating systems, while the pilots of the smaller planes are hampered by heated suits, oxygen apparatus, etc. In fact, the latest bombers, typified by the Martin Baltimore, have the speed of pursuit planes, which complicates the problem considerably.

Aluminum

There has been a great deal of discussion about the possibility of employing reworked aluminum scrap in the manufacture of aircraft aluminum alloy and experts disagree upon the feasibility of the plan. It is, therefore, very interesting to find out what becomes of the tremendous quantities of high-strength aluminum scrap left over in the manufacture of airplane structures.

Consolidated Aircraft casts its dural scrap into standard sections, which are used in building jigs and tools for the manufacture of bombers. The material is not only light, but expands and contracts at the same rate as the work, which is very important.

Jet Propulsion

While the war has halted most of the work on rocket propulsion, some of the European countries have been experimenting seriously with auxiliary jet propulsion. So far this has taken two forms. One is an auxiliary jet fed by a combustion chamber and used only as a take-off booster; the other is an exhaust pipe which uses the engine's exhaust as a propulsion jet, recovering part of the power otherwise lost.

Landing Lights

Many of the types of lights on the borders of landing fields project far enough above the ground to be a hazard to any plane which, because of a faulty landing, might run over them. A new type is mounted in a flexible rubber mounting so that it simply sinks to the ground level in case of accident, neither smashing the plane nor the light. The rubber ring also seals the light against moisture.

Machine Gun Sights

In the last war the sighting of the machine guns in the gunner's tourel and the fixed guns was more or less a "hit or miss" proposition, even when the windvane sights were used. Modern sights are very accurate and rather complicated, many containing correctional gyroscopes. I was shown recently a projected sight designed by a man who is "tops" in his profession. It should revolutionize machine gun firing from modern high speed planes.

Direct Fuel Injection

The success of the German engines having direct direct fuel injection and its inclusion in the new Ford aircraft engine has directed public interest on this type of mixture control. The Italians are experimenting with an electrically operated system, which has been used in experimental racing engines with success.

Contra Props

This is the new British name for two propellers mounted on the same axis and turning in opposite directions. The latest designs include a type in which the pitch is changed simultaneously and the whole assembly is mounted on a hollow propeller shaft so that a cannon can be fired through it. This is very important where the cannon is mounted directly on the engine, which is used to absorb recoil.

Light Planes

The light plane may now be fitted with controllable pitch propellers, which will give them the "gear shift" advantages. Several years ago a single blade controllable pitch propeller fitted to a light plane made a sensation. Variable pitch propellers are being produced weighing but 36 lb. for 75-110-hp. and 60 lb. for 125-250-hp. engines.

Dive Bombing

Speaking of dive bombing brings to mind a most clever detail of the Junkers Ju88 dive bomber. This plane has an automatic arrangement to pull it out of a dive, relieving the pilot's mind on this score. It also has a red line drawn along the pilot's window at an angle of 40 degrees, the normal diving angle of the plane. Thus the pilot can look out of the window at his target and keep the line on the horizon to make certain that he is diving at the right angle. Supplementary markings show 50, 60 and 70-degree angles.

Starters

Those who remember the four running men snapping the "prop" over-center on the World War Liberty Engines will be interested in the new type of starter used on the large engines of today. Many can remember the first crude electric starters, the complicated air or carburetted air starters followed by the hand inertia and the electric inertia types, many of which are used today.

The new technique is to use a special cartridge, not unlike a blank shotgun shell with a special slow-burning powder, and firing into an expansion chamber, which in turn feeds the gas under pressure into the engine's starter. I remember an early cartridge starter made by Farman in France, in which a standard 12-gage blank shotgun shell was used and fired directly into one of the engine's cylinders, thus spinning it over several compressions. Naturally, the start was rather violent and all of the wadding and burned powder went right into the engine's "innards".

Rotating Wing Aircraft

Despite the apparent lack of interest in the Autogyro and other rotating wing aircraft, there is an immense amount of work going on behind the scenes and we soon may see some rather interesting developments. The ability of the rotary wing plane to take off and land in limited spaces and to hover makes it very valuable for observation work, particularly from the decks of vessels.

Steel Propeller Blades

Many people in the industry do not realize that the steel propeller blade has made tremendous advances in the past few months and has become a major factor in propeller manufacture. After years of partial success, the manufacture of steel blades now has been perfected and they are being produced in great quantities. For very large propellers the plastic coated wood blade made on the Schwartz principle should play an increasingly important role because of its light weight as compared to metal.

1942 Studebakers

STUDEBAKER cars for 1942 again will be produced in three lines—Presidents, Commanders and Champions. In the Champion line there are two-door sedans, four-door sedans, three-passenger coupes and "double-dater" coupes for five. Both President and Commander groups have four-door sedans, Land-Cruiser sedans, with four windows, and Sedan-Coupes for six. Custom and DeLuxe style models are available in each group of cars, while in President and Commander lines there are also Skyway models.

The new models, styled by Raymond Loewy, have wide and low front ends garnished with chromium plating around louvers, bumpers and headlamps.

Light pistons of alloy cast iron are used this year, cam-ground and Parco-Lubrized. As indicative of the care taken to minimize piston weight, it is stated that the internal diameter of the Champion piston is held to a tolerance of 0.004 in. The Parco-Lubrizing process forms a thin protective coating on the piston which tends to prevent scuffing and scoring, especially during the running-in period.

The outstanding innovation by Studebaker for 1942 is the Turbo matic drive, which is an optional extra on Commanders and Presidents; it comprises a fluid coupling, an automatic clutch, and a transmission with semi-automatic overdrive. The clutch pedal is eliminated, but otherwise the controls are substantially standard.

The transmission is of the three-speed variety, but the low gear is intended for use only when starting under unusually difficult conditions. The upper two gears in the transmission provide two speed ranges, for use in city and country driving respectively. Owing to the use of the overdrive, two ratios are available in each range. At speeds above 15 m.p.h., the change from direct to overdrive is accomplished by momentarily lifting the foot from the accelerator pedal, while the return to direct drive can be made at any speed by pressing the accelerator all the way down.

Engine power is transmitted through the fluid coupling at all times, which ensures that the start will be smooth regardless of the gear engaged. A conventional single-plate clutch is located immediately back of the fluid coupling. It is controlled by the inlet-manifold vacuum, operating on a diaphragm connected to the clutch mechanism.

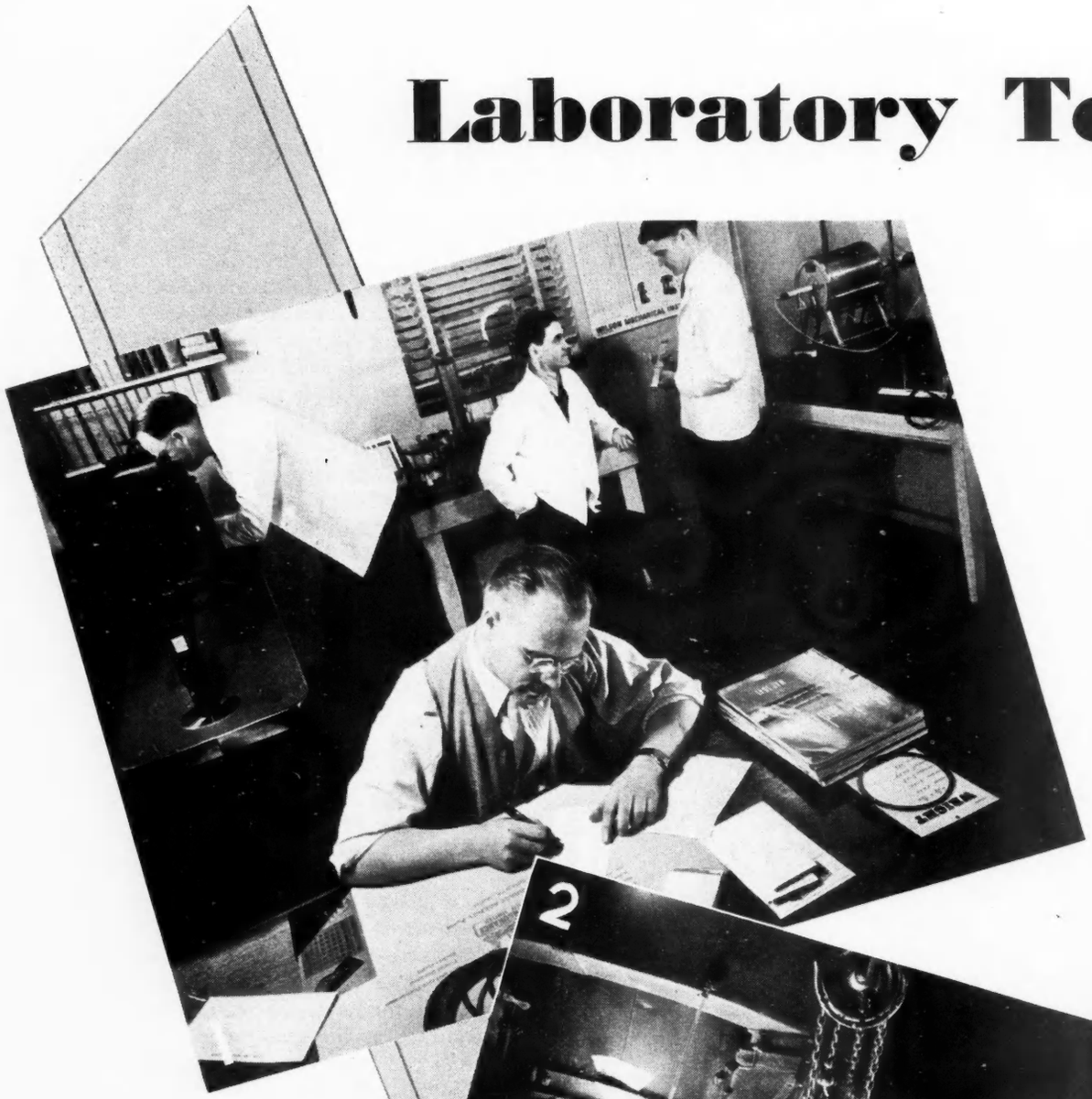
The overdrive operates at speeds above approximately 15 m.p.h. Control is by a transmission-mounted solenoid which operates a pawl to lock or release the overdrive. At speeds below 15 m.p.h. the governor, driven off the rear of the transmission, keeps the transmission solenoid circuit open, and the pawl is then in the unlocked or outward position. Thus all starts are made with the overdrive cut out.

At speeds above 15 m.p.h. the governor completes the circuit to the transmission solenoid. Then, as soon as the throttle is released, the solenoid pushes the pawl into the locked or overdrive position. When the accelerator is pushed clear to the floor, a switch in the throttle mechanism breaks the circuit of the transmission solenoid, permitting the return spring to pull out the pawl. Consequently, the lower ratio is instantly available for bursts of acceleration. The shift lever is mounted on the steering column. Normally it is used only for changing from one speed range to the other. To eliminate the possibility of starting the engine while in gear, a switch on the shift mechanism

(*Turn to page* 55, *please*)

Here is shown the Commander Custom Cruising sedan for six passengers. This model is also available on the President Eight chassis

Laboratory Tests



1. *A view in the metallurgical and chemical laboratories at Sparta. At the left in the rear is the new Bausch & Lamb microscopic camera.*

2. *Tapping one of the cupolas in the Sparta foundry. The ladle is immediately transported to the pouring department. The man at the extreme right, in the background, is taking a routing check of the temperature of the molten metal with the familiar optical pyrometer.*

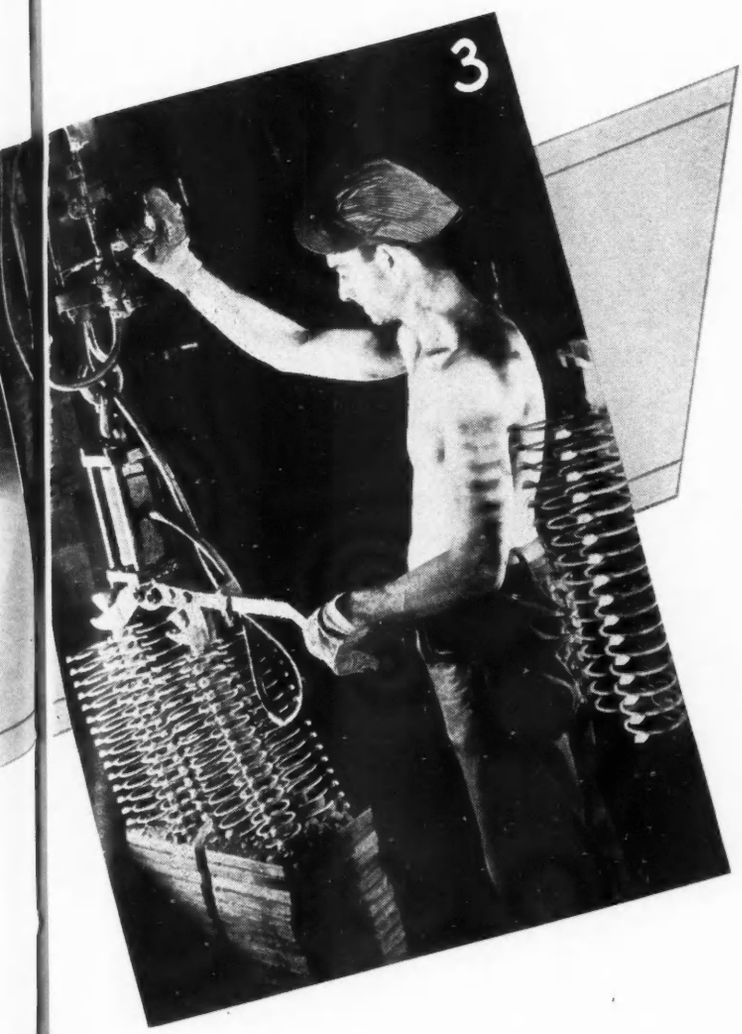
3. *Stripping rings from the molds in the shake-out department at Sparta is a job requiring skill and speed born of long experience.*

Guard Muskegon Quality

By JOSEPH GESCHELIN

LOOMING as one of the outstanding means in piston rings—devoted exclusively to the production of castings and finished rings for manufacturers only—the Muskegon Piston Ring Co., Muskegon, Mich., produces upwards of 60 million piston rings per year at Muskegon, and about 100 million ring castings in its foundry at Sparta. Under the impetus of national defense, the company is devoting much of its energies to the production of aircraft engine piston ring castings, special bronze alloy rings for various uses, including variable-pitch propellers and ring castings for large Diesel engines.

The company was organized about 20 years ago as the Sparta Foundry Co., later changing its corporate name to Muskegon Piston Ring Co. Today, the manufacturing plant in Muskegon produces finished rings for some of the largest passenger car and truck builders in this country. The foundry division at Sparta makes ring castings for Muskegon as well as for other customers. Both plants have been modernized in recent years and both boast plant additions demanded by the constantly expanding business. The foundry has some 185,000 sq. ft. of floor space while the machine shops have 52,077 sq. ft.



Although piston rings and castings are supplied to a relatively few customers, replacement requirements of passenger car and truck manufacturers entail a great variety of oversizes, boosting the total number of different rings to a sizable figure. Some idea of this may be gained from the fact that the foundry has in its fireproof pattern vaults something over 3000 different metal patterns.

As to variety of product, the line includes automotive rings ranging from 1 in. to 4 in. in diameter, and upwards, to rings of 31 in. in diameter for industrial applications.

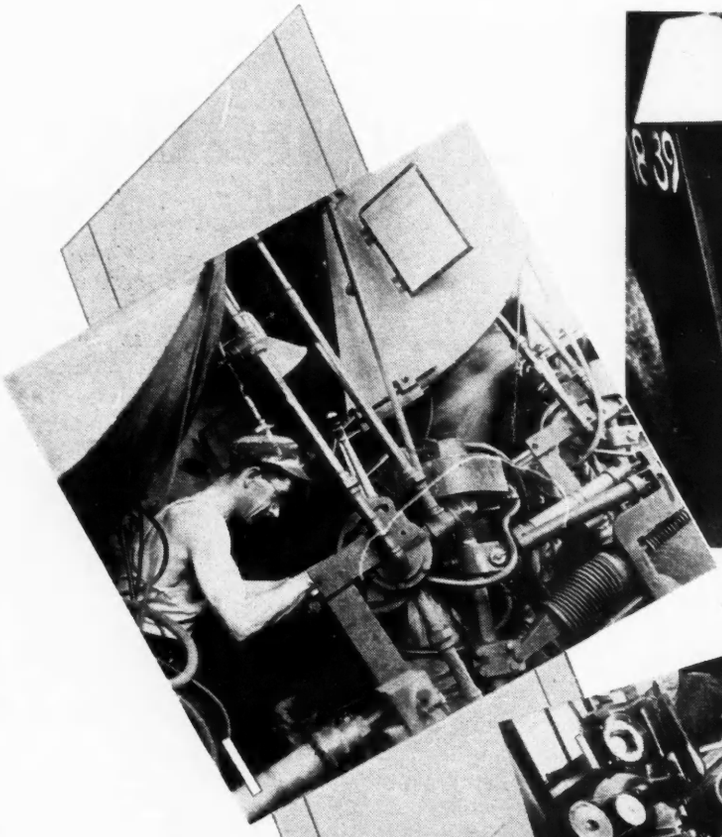
As pointed out by Paul S. Lane, research engineer of the company, in a recent article, the piston ring represents the only item of cast iron in an aircraft engine. Its physical and chemical properties must be subjected to the most searching scientific controls and advanced foundry practice to assure the service life and safety of life and equipment in military airplane operation. That these requirements are met successfully in large volume production may be taken as a tribute to the engineering research and foundry laboratory controls which are evident in the fundamental set-up of the M-P-R organization. It may be noted, too, that these attributes are extended to the elements of quality control both in the foundry and in the machine shops, as will be noted later.

Sparta reveals two different foundry operations—the so-called old foundry, its original plant, now devoted to the casting of large rings; and the new foundry set up for handling the automotive and aircraft ring castings in huge volume. The old foundry has a single cupola with a capacity of six to seven tons of iron per hour; the new foundry has three cupolas each one with a rated capacity of five tons per hour.

In addition, the foundry has a large machine shop with the latest type of equipment for snagging outside diameter, inside diameter, and grinding the faces of ring castings. This, in turn, is supplemented by a large inspection department for quality control.

As a measure of service facilities for the national defense, as well as for the normal requirements of its customers, the foundry has a storage room containing well over four million piston ring castings in a variety of most wanted sizes ready for shipment on a moment's notice.

The new foundry is an excellent example of modernity and good housekeeping. It is divided into four



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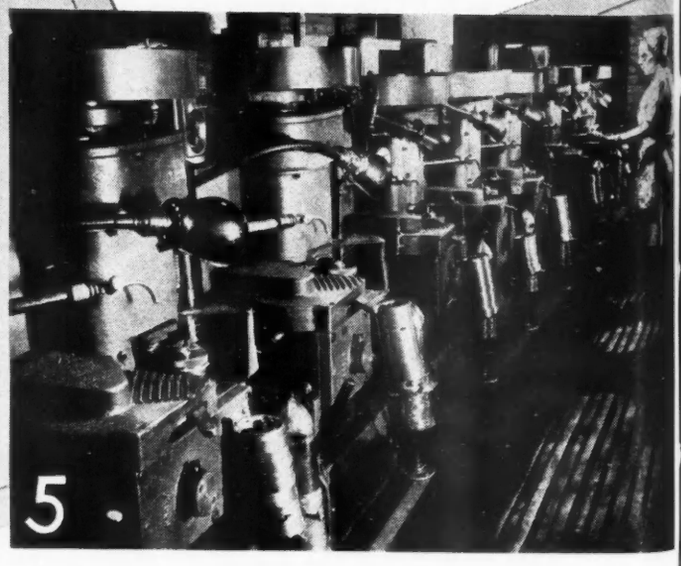
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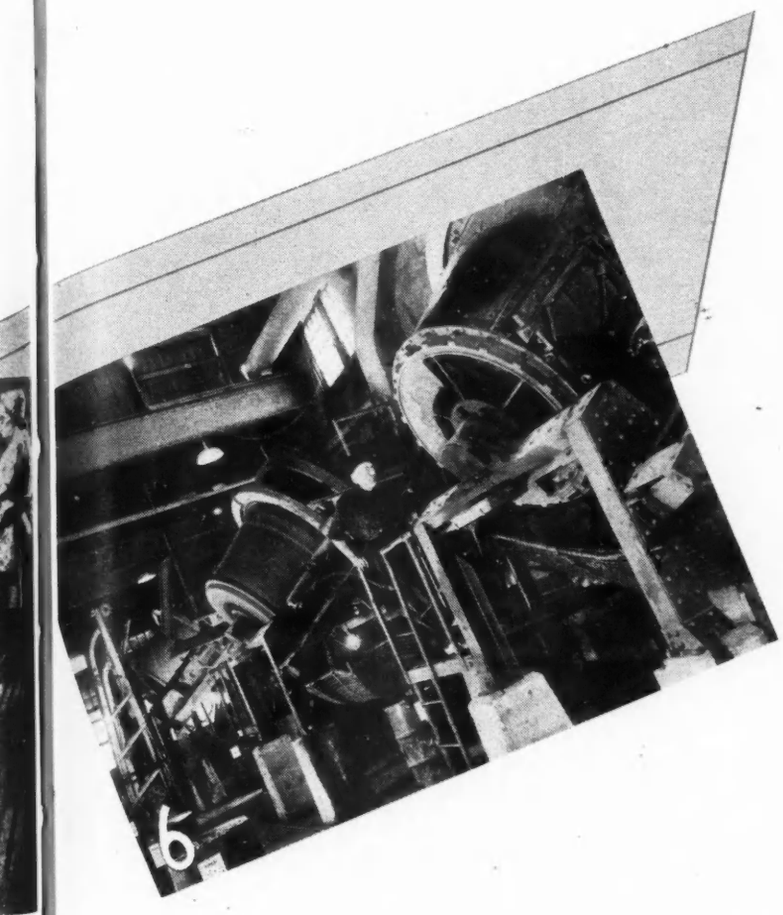
distinct departments—the cupolas, the molding room, the pouring room, and the shake-out—each one separated physically. Thus the molding room is insulated from the metal handling departments and free from the effects of temperature, humidity, etc. On the other hand, the pouring lines are insulated from the molding department and are singularly free of sand, and dust, and fumes.

The molding department is a long, narrow bay with excellent ventilation, provided with a battery of 20 semi-automatic molding machines designed by the company. Outstanding feature of these machines is the use of 16 in. hydraulic cylinders, producing a mold pressure of at least 16,000 psi, assuring tightly packed and perfectly formed molds. Each machine has a capacity of 1400 rings per hour, with an output of 200,000 rings per eight-hour shift. Sand for each machine is supplied through individual ducts from the central sand-handling machine located in the cupola department. Automotive rings are molded eight to a mold in stacks 16 molds high.

The pouring department has 40 mechanized gravity roller conveyor lines, two for each molding machine. It is served by two ladles from the cupolas, each ladle having a capacity of 200 lb. of metal.

The shake-out department, too, is insulated from the other rooms and is provided with an extensive exhaust system which effectively removes dust and fumes, making it an excellent work place for the operators while, at the same time, shielding the pouring room and molding department from the dirt and fumes usually associated with the shake-out operations.



In addition to the exhaust system, the shake-out has been equipped with auxiliary exhaust fans to provide good ventilation. Similar exhaust fan units have been installed in the other departments to provide good working conditions.

Now for some comments as to quality control. In the first place, the foundry boasts scientific laboratory facilities for the chemical and physical analysis and testing of iron and of all the raw materials that go into a foundry operation of this character. Among other things, these laboratories test the raw materials such as sand, pig iron, coke, limestone, etc. In addition, there is a laboratory station adjacent to the sand handling machine for making tests every 30 min.—of permeability, strength (green and dry sand), and moisture content. This is supplemented by a daily sampling for grain size of the sand mixture, collecting screened samples which are suitably identified and tested weekly.

Coming to the iron itself, we find that the ingredients of each cupola charge are weighed accurately so as to meet the desired specifications. A representative of the metallurgical department is stationed at the cupolas to check on each heat and tap. He takes ring samples every hour for chemical analysis; daily samples for testing—strength, flexibility, and tension, of ring samples; Rockwell hardness tests every 45 min.; and a chill test from every tap. An interesting feature of the latter test is the fact that each chill test sample is poured into a large water-cooled block which is held at 55 deg. Fahr. to assure uniformity.

Quality control is carried into the other departments to the same degree. For example, in the shake-out an operator makes a standard file test for hardness on a sample of every ladle. In addition, a lathe test is made on samples of each lot.

Chief control in the molding department is the periodic inspection of the metal pattern equipment. Due to the M-P-R method of casting, in which the pattern is so designed as to produce a measured initial tension in the ring casting, extreme care must be exercised to assure the maintenance of pattern form. To this end, each pattern is checked with a master gage before it is released from pattern stores. Similarly, the patterns in use in the molding depart-

1. ***Close-up of one of the battery of specially-designed high pressure molding machines in the molding department of Sparta.***

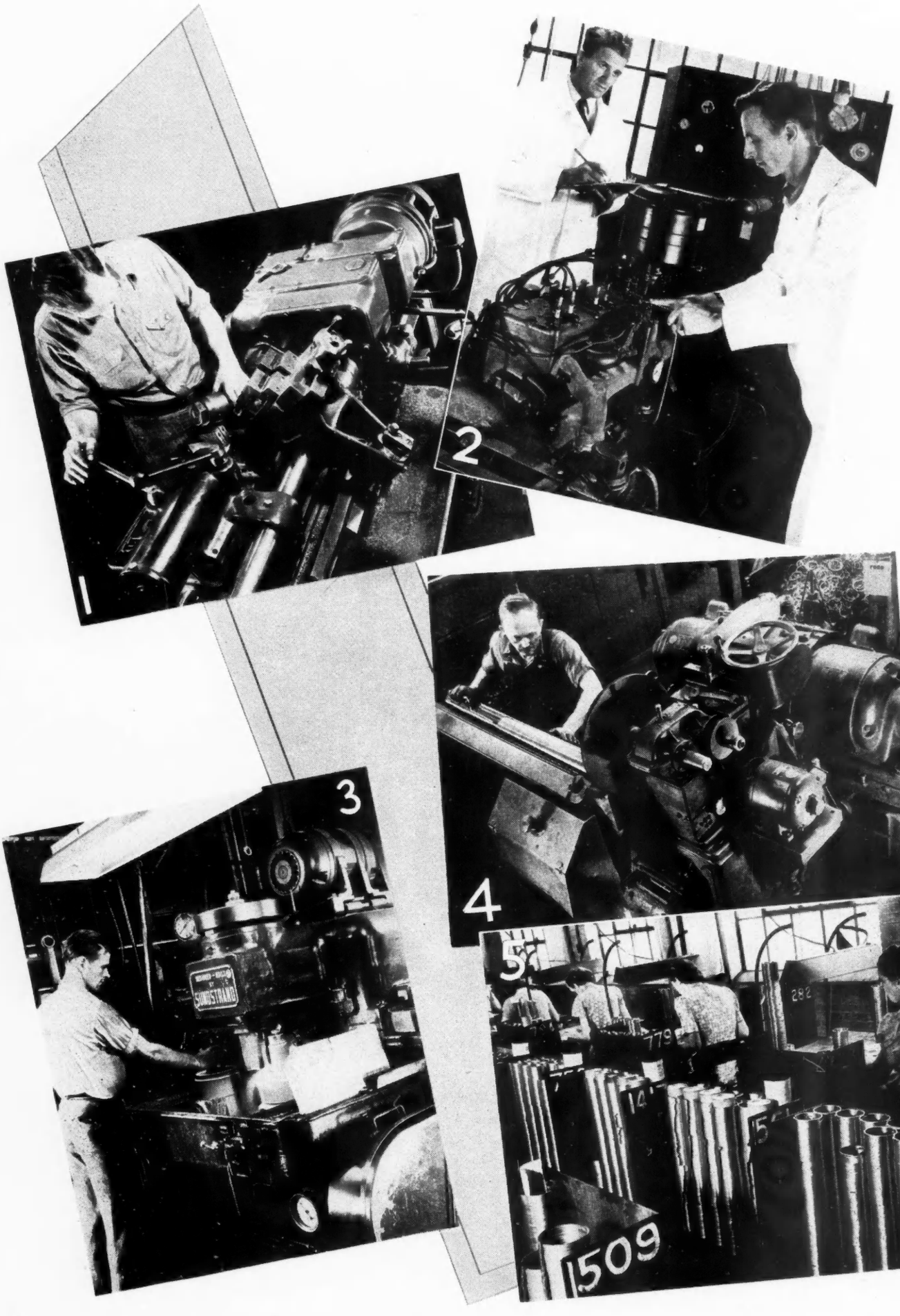
2. ***View in the inspection department at Muskegon, showing the gap inspection.***

3. ***Intimate view of one of the modified Besly grinders at Muskegon, used for finish-grinding the sides of piston rings.***

4. ***Second inspection—a re-check of piston ring castings at the Sparta foundry division. The large aircraft engine rings for Wright and Pratt & Whitney may be seen in the foreground.***

5. ***Here is a battery of special milling machines used for milling slots in oil rings at Muskegon.***

6. ***A battery of three of the latest type Sly tumbling barrels is doing yeoman duty at Sparta.***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ment are checked with the same gages twice each shift.

Cupola management is controlled in many ways to assure the quality of the iron. In the first place, the air blast to each cupola is controlled with Foxboro automatic control units. The humidity of the air entering the cupolas is precisely controlled by means of special equipment which dries the air, then preheats it to about 450 deg. Fahr., assuring a uniformly dry mixture independent of atmospheric conditions. One unit, representing the most modern type of air-conditioning equipment known to the art, was installed in connection with the larger cupola just a few months ago. This is the Kathabar system developed by the Surface Combustion Co. In this system, the air is dried by means of a lithium chloride solution which has the ability to absorb large quantities of moisture with a relatively small unit. The Kathabar unit is so designed as to maintain a constant solution strength while automatically maintaining a variable solution temperature in accordance with the variation in atmospheric moisture content.

Of major importance in the quality of piston ring iron is the fact that cupola iron is poured at the extremely high temperature of 2800 deg. Fahr. (average). This is checked with an optical pyrometer for each tap and recorded on a log sheet which is filed in the laboratory.

After the ring castings have cleared the shake-out, they are tumbled or rattled depending upon size. Among the modern equipment for this purpose is a battery of three big Sly tumbling barrels, mounted high so as to facilitate loading into containers, fed by an automotive elevator conveyor. Tumbled ring castings then are taken directly to the inspection department for preliminary checking before machining. Here, under the latest type fluorescent lamps, the castings are inspected for visible defects. Test samples for machining tests then are taken from each lot and thereafter the castings are routed to the machine shop. Here will be found a variety of grinding machines for dressing the faces, for snagging outside diameter and inside diameter. One of the most modern machines in this department is a huge Hanchett disk grinder which takes abrasive wheels up to 30 in. in diameter. It is fitted with two wheel heads, each individually belt driven.

Outstanding mechanical equipment of the kind familiar in automotive machine shops is the new battery of four Sundstrand milling machines. These are hydraulic machines, fitted with two work arbors, tooled with slitting saws, and have a capacity of 2000 rings per hour per machine.

Muskegon Plant

While the foundry serves both the Muskegon division and outside customers, the Muskegon plant produces finished rings of all types for passenger car manufacturers, truck builders, and diesel engine producers. The ring castings for this purpose are received from the foundry disk-ground on the faces and snagged.

As in the case of the foundry, the Muskegon operation emphasizes quality control based upon a constant program of engineering research. Here will be found an excellent engine laboratory equipped with four Taylor Hi-Eff hydraulic dynamometer stands, with a full complement of instrumentation mounted on a central panel. In addition to dynamometer research, the engineering department carries on field service tests on a fleet of cars available locally for this purpose.

Supplementing the engine laboratory work is the research laboratory provided with special testing equipment for wear tests, for tension testing by various techniques, fatigue machines, and microscopic instruments. *(Turn to page 55, please)*

1. ***One of a battery of two Fay automatic lathes for turning and grooving rings at Muskegon, tooled with cemented-carbide-tipped tools.***

2. ***Close-up of one of the dynamometer test stands in the laboratory at Muskegon. There is a glimpse of the panel control board which serves all of the test stands in this group.***

3. ***Piston rings are slotted in stacks on this two-spindle Sundstrand hydraulic milling machine. A battery of four of these modern machines is found in the Sparta foundry.***

4. ***Sides of piston ring castings are ground on this big Hanchett grinder. This machine has two individually-driven wheel heads, is one of the new grinders at Sparta.***

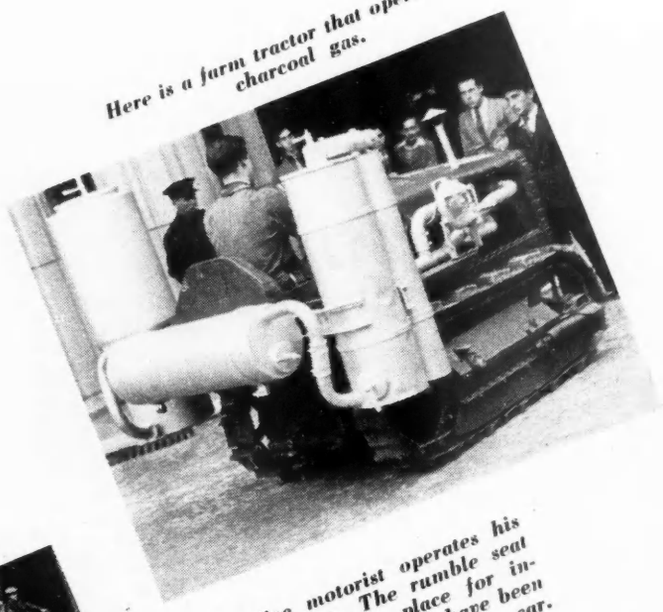
5. ***First step in the new inspection department at Muskegon is the visual inspection of piston rings. The rings come in from the final operation—boring—in the machine shop, loaded in special containers as shown, being transported past the inspection benches on a gravity roller conveyor. As the operators complete their inspection, they transfer the rings to a conveyor on the other side of the bench which carries the rings to the final inspection operations.***

6. ***View of the large battery of special single-spindle drilling machines which are employed for the drilling of holes in special oil rings at Muskegon.***

ERSATZ FUELS TEST

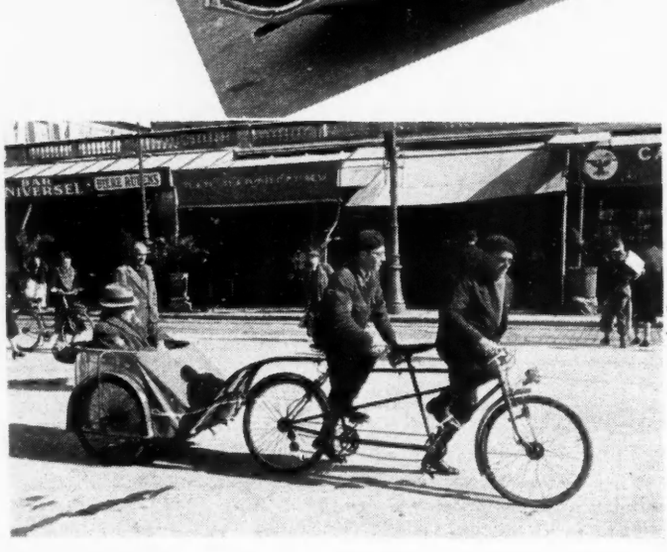
This bus which services the Cote d'Azur, famous Riviera coastline, has its gazogene plant installed on a trailer.

Here is a farm tractor that operates on charcoal gas.



(Left) A Nice motorist operates his car with acetylene. The rumble seat provided a convenient place for installing the cylinders, which have been painted the same color as the car.

A Vichy motorist has installed a gazogene boiler in the trunk of his Citroen car.



Fuel problems have been eliminated in taxi service by using these bicycle-drawn trailers.

FRENCH INGENUITY

FRENCH motorists now are experiencing a grim repercussion of modern warfare while European military machines drain their gasoline supplies. Yet in unremitting and undaunted efforts they attempt to overcome the shortage. Mostly used is an ersatz product called gazogene, presumably a charcoal derivative. As a result many strange appearing automobiles are on the streets of French towns and cities. All trucks and buses have been changed over to substitute fuels. A new device is the Ghezzi carburetor, which permits the use of either alcohol or gasoline.

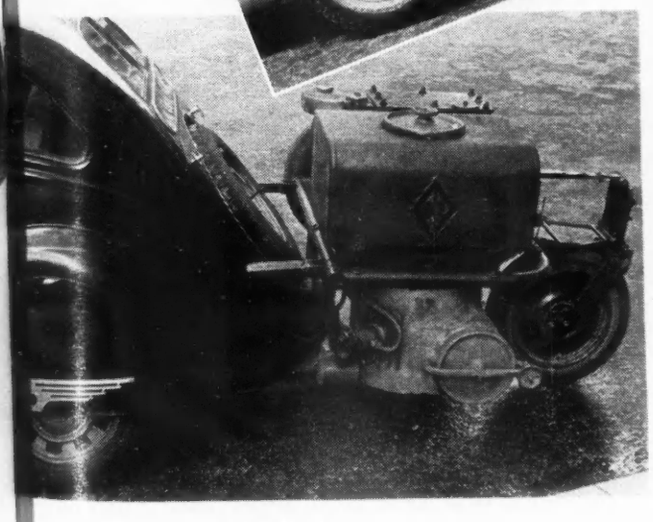
These pictures taken recently in various sections of France tell a realistic story of what is borne of necessity.

A gazogene kettle has been mounted on the rear of this Renault car, which was photographed near Rouen in occupied France.

Photos from Three Lions

Truck station of the Ecole de Gazogene of Draguignan, unoccupied France, where drivers are given special instruction in handling vehicles that use gasoline substitutes.

An attendant is cleaning the gazogene kettle mounted on the rear of a French Riviera bus.



A Peugeot passenger car with its recently acquired fuel plant.

"Easy Roll" Trailer Axle

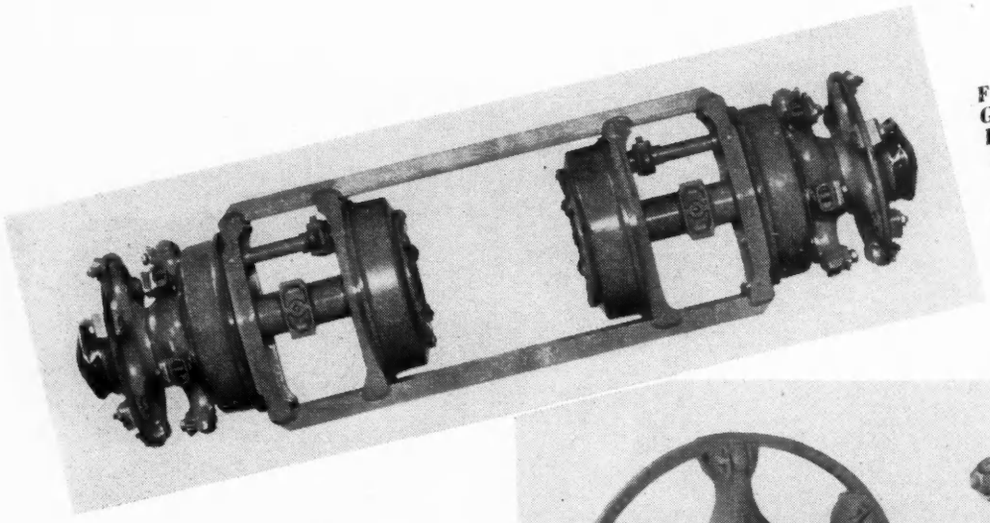


Fig. 1
General view of the Easy Roll trailer axle assembly. Note the independently mounted wheel spiders, with outer brake drums attached to the inner spiders, inner drums communicating with the outer spiders.

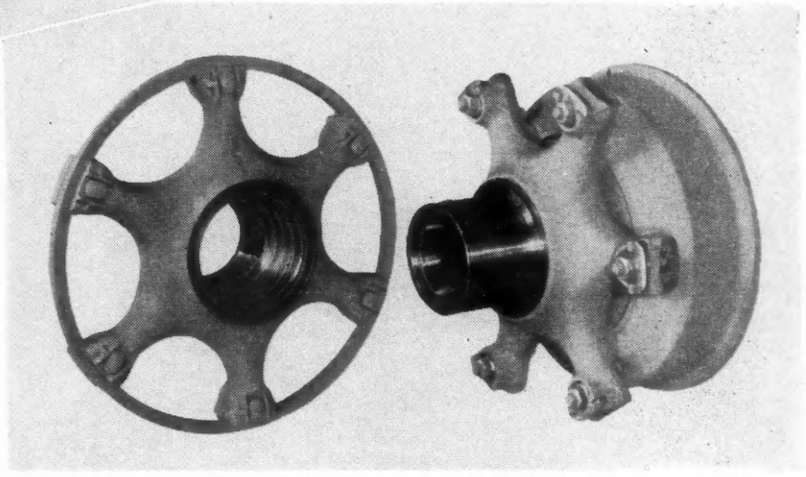


Fig. 2
This shows a pair of wheels dis-assembled, revealing the bearing surface on the inner hub on which the outer hub rides.

ONE OF the most striking innovations in equipment for heavy duty vehicles is the "Easy Roll" dual-tired trailer axle recently placed in production by the Clark Equipment Co., Buchanan, Mich. Basic features of the new axle include:

(a) Independently rotating wheels.

(b) Four sets of brakes—individual brake assembly for each wheel.

Reference to the general view of the complete assembly (Fig. 1) shows the independently mounted outer wheel spiders and the four sets of brake assemblies—one pair for the inner wheels, attached directly to the spider, while the inner pair connects to the outer wheel spiders through torque shafts. The overall length of the unit is controlled only by the spring centers and tire spacing, since this axle design is free of the usual handicap of wide brake drums which must be fitted between the spring and wheels.

For the intimate details of construction we refer you to Figs. 2 and 3. It will be noted that the inner wheel spider is provided with a hub and brake drum mounted in the conventional manner. The outer spider, on the other hand, has a special plain hub, fitted with a bushing, permitting it to rotate freely on the outer machined surface of the inner wheel hub. Normally the two spiders turn together on the anti-friction bearings of the inner hub. However, the outer wheel is free to rotate independently when the vehicle turns a corner or is on curve or when road crowning or other surface conditions make it necessary to have a differential movement of the two wheels.

It will be noted that the outer spider is fastened to a short torque shaft which extends through the hollow supporting spindle and drives the brake drum located on the inner side of the spring seat. To provide clearance for this drum, two cross channels are used to connect the two sets of wheels and their supporting members. Of particular interest is the dual function of the torque shaft fastened to the outer wheel. The outer end is provided with a flange to which the hub face of the outer wheel is securely fastened. The inner end of the shaft is housed in a sealed, anti-friction bearing, supporting the free end of the shaft. The shaft thereby acts as a lever, holding the outer spider in a perpendicular position, thus preventing any uneven stresses in the spider or uneven pressure on the bushing.

There is said to be no scrubbing of tires when rounding a corner or curve, and no stalling of motors when maneuvering in confined places such as dock, transfer yards and sharp mountain curves. The quadruple braking system causes the tires to come to

with dual tires, has independently rotating wheels and individual brake assembly, for each of them.

a rolling stop regardless of their individual speed, or the character of the road surface since they are never locked together, either before or during the application of the brakes.

An important feature of the braking system is the use of four 16-in. drums. The location of the brake drums, allowing for free circulation of air, saves brakes, drums and tires. The four 16 in. x 3 in. brakes are equal in area to two 17¼ in. x 5.6 in. brakes. The 402 sq. in. of brake lining is equal to 1 sq. in. for every 40 lb. of vehicle weight, or the rated weight on this axle.

Adoption of narrow brake drums provides a stronger and more rigid construction since the drums are not so prone to bell-mouth upon heavy brake application. The latest type of cam—½ in. constant lift—is employed.

According to the manufacturer the new "Easy Roll" trailer axle affords the following unique advantages:

1. The independently rotating wheels increase tire life by eliminating drag or scrubbing on curves, or on irregular surfaces.

2. Relieves the stress between the dual tires, thus reducing internal tire friction and tire temperature.

3. Removes strain and overload on rim mounting parts, thus preventing rim from coming off.

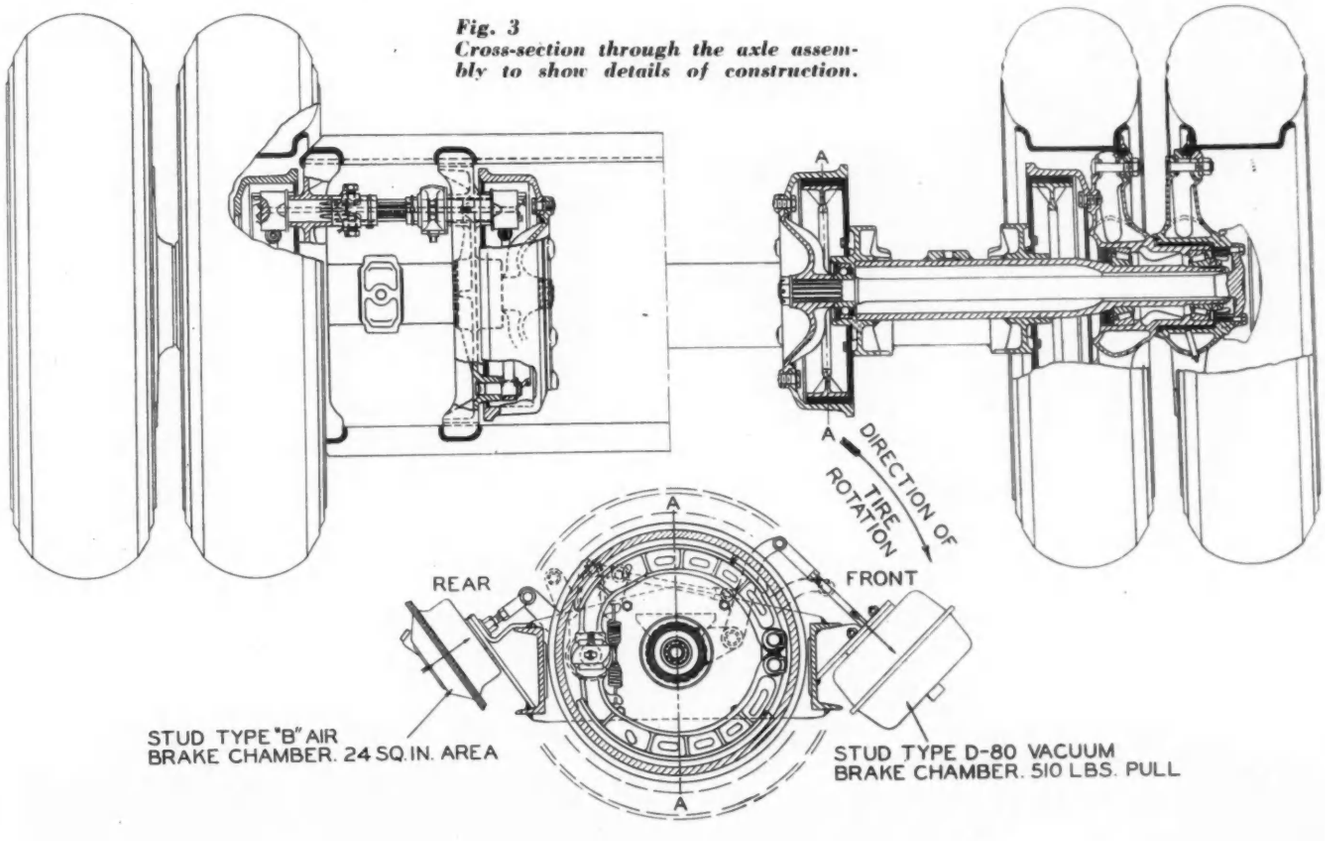
4. Provides true alinement of tires, utilizing the well known Clark principle of allowing free accessibility to the valve stems at all wheel positions, thus permitting easy and rapid inspection, or tire inflation.

5. Eases maneuverability of the trailer, whether single or tandem axles are used.

6. Improves gasoline mileage.

7. Permits use of worn tires since further pitting and scuffing are retarded.

Fig. 3
Cross-section through the axle assembly to show details of construction.



MEN

FOR SETTING Radiagraph cutting torches for any desired angle of cut, a new protractor-type torch holder has been introduced on the market by Air-Reduction Sales Co., New York. As an example of the type of work for which the new holder can be used to advantage, a bevel-cut billet is shown in the photograph. A circular knurled knob permits angular adjustment, as shown on the scale. The new holder, which has a 90-deg. range, can be attached to any standard Airco Radiagraph.

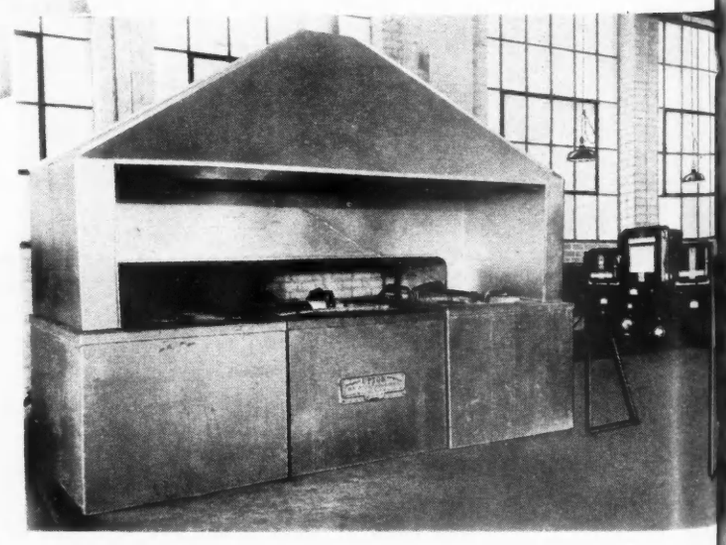
THE RED RING hand profiler, a new product of the National Broach & Machine Co., Detroit, is intended for the production of intricate mechanical parts, such as certain aircraft parts and bearings. It operates on the principle of duplicating the profile of a master pattern by properly guiding an end mill, using the master pattern as a guide. The head carries two cutter spindles on 10-in. centers, which can be used simultaneously.

In order that the cutter may trace the path of an irregular curve, movement must be provided in two directions in the horizontal plane. The head carrying the cutter spindles moves toward and away from the operator as he faces the machine, and the table which carries the work simultaneously moves laterally. The cutter head has a range of motion of 4 in. to each side of the center, the work table of 10 in., hence the total area covered by the cutter is 160 sq. in. Both slides are equipped with adjustable stops. By locking either slide, linear milling may be done without the use of a master pattern.

Red Ring hand profiler

UPTON ELECTRIC FURNACE CO., Detroit, has placed on the market a line of internally-heated electric salt-bath furnaces. Temperatures of from 300 to 2500 degs. Fahr. may be produced in these furnaces, which are said to be suitable for carburizing, cyaniding, hardening of molybdenum and tungsten high-speed steels, selective hardening, brazing, heating for forging, treating aluminum alloys, tool tipping, etc.

Two types of furnaces are being offered. The high-temperature type has an inner lining of alloy steel insulated on both sides, the interior of the pot itself being lined with two kinds of ceramic brick. The exterior of the pot assembly is welded plate. The low-temperature pot follows the same general design, but has no alloy lining. Both types are built with inclined walls to better withstand the



Upton furnace installation for hardening high-speed steel, including pre-heat, high-heat and quenching sections

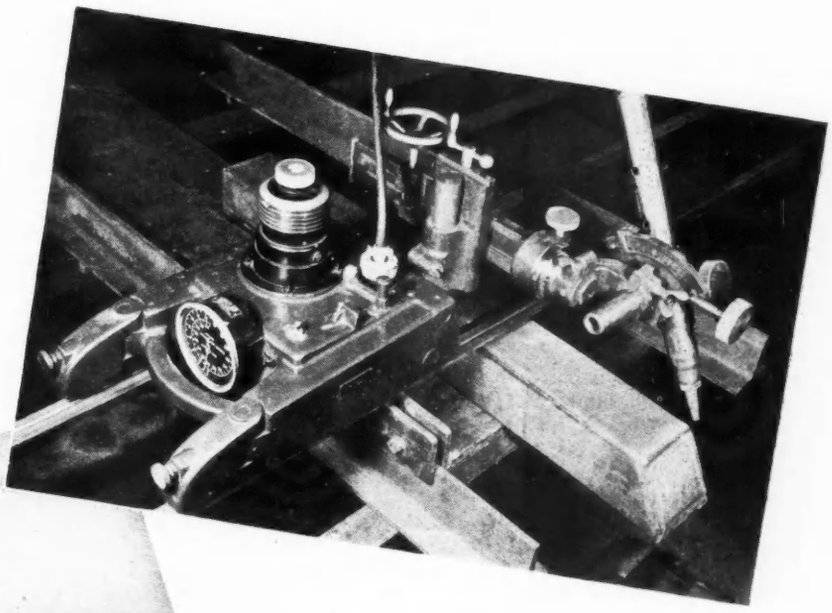
and MACHINES

effects of expansion and contraction due to heating and cooling.

Current for heating the salts is carried by electrodes located in opposite corners of the pot. These approach each other toward the bottom of the pot, thereby increasing the current density and the heat generation at the bottom, which is a special feature of the Upton furnace.

A SMALL size of horizontal honing machine, adapted to hone long bores of up to 1½ in. diameter, is the No. 1 hydraulic honer just announced by Barnes Drill Co., Rockford, Ill. The standard length of stroke is 8 ft., but the stroke can also be made as small as 6 ft. and as long as 12 ft. The machine comprises a hydraulic cylinder with piston for reciprocating the carriage. Rifle barrels, tubes and cylinders are honed in this machine by simultaneous reciprocation and rotation of the honing tool. Ordinarily the honing tool is driven so as to allow no dwell at the end of the stroke, but for honing blind-end holes a special control feature known as the hydraulic dwell is provided. This causes the spindle to hesitate slightly at the blind end, enabling the tool to remove all of the stock. The illustration shows the honer arranged with 8-ft. working stroke, reciprocating carriage for rotating spindle traveling on finished bar tracks, electrically-driven Allis-Chalmers centrifugal coolant pump, necessary mechanism for operating Micromatic hydraulic-type tooling, and two work supports to

(*Turn to page* 56, *please*)



(Top) Southwark-Tate-Emery Model 60-35 Universal testing machine

(Above) Airco protractor-type torch holder

(Left) Barnesdril No. 1 honing machine

PRODUCTION LINES

Tooling Turrets

A handsomely jacketed loose-leaf book, "Turret Lathe Tools," has just come off the press and is being distributed by the Gisholt Machine Co. This is a practical handbook for the master mechanic and tool engineer, covers the gamut of standard tools representing the best current practice in turret lathe tooling. By index it describes ten basic types of tool sets including—standard tool sets, chucking tools, bar tools, machine attachments, etc.

Fluid Drive

We have reason to suspect that several more makes of cars will be able to offer fluid drive as optional equipment on 1942 models. It is of interest to find that although Hydra-Matic transmissions and Fluid Drive as typified on Chrysler Corp. cars are listed at extra cost, a large proportion of new car buyers are ordering the special equipment. At the moment, Olds alone has some 100,000 Hydra-Matic units in the field.

Bi-Metal Rings

A question has been raised concerning the use of bi-metal piston rings in automotive practice. This refers particularly to the practice of making rings with inserts of babbitt or brass or of some other suitable bearing material which will provide permanent anti-scoring properties. So far as we can learn the applications for special rings of this character are thought to be limited to industrial engines of fairly large bore where the operating conditions are unusually severe. Several piston ring engineers have assured us that they know of no tendency to apply this type of ring in aircraft engines, for example. It may be that the current practice of applying chemical coatings or oxidized coatings on the surfaces of the rings has provided the best known protection against premature scuffing or wear, without affecting to any degree the primary functions of a piston ring in a high duty engine. One patented design developed for use in a popular diesel engine employs another important technique. In this case, the face of the ring has a number of narrow grooves. The ring is tin-plated by immersion in an electroplating tank for five hours so as to produce a coating of 0.004 in. in thickness. This fills the grooves with tin plate. The face of the ring is turned initially so that only the tin in the grooves is exposed. The theory is, that as the ring face wears, the groove will continue to present an unbroken tin coating, thus preserving the bearing quality of the ring for its entire life cycle. If there are other developments of this kind, we should like to hear about them and note them in this column.

Making Ordnance

We have just received numbered volume 61 of a blue-print book on the "Lo-Swing Method" used in armament manufacture, issued by Seneca Falls Machine Co. This is indeed a valuable handbook on the subject and of timely interest in these days of producing the weapons of defense. The book is divided into three major sections—one on the tooling for gun barrels, one for shell turning, and the last on a number of aircraft parts. The section on gun barrels shows the tooling for the Browning, Bofors, Oerlikon, and several others, including the 37 mm. and 75 mm. tank guns. Distribution of this valuable guide on modern ordnance practice is quite limited but the information it contains should be of great value to production men contemplating defense contracts in the near future.

Real Service

One of the finest examples of service in advertising—in our opinion—is the Pratt & Whitney ad that appeared in AUTOMOTIVE INDUSTRIES, Sept. 1. Touching on the subject of machining heat-treated alloy steels at 300 to 400 Brinell hardness, P & W gives some valuable information as to the form of cutting tools—relief, rake, clearance, etc.—for milling, tapping, reaming, etc. In addition, there is an interesting note as to cutting fluid practice. For these operations, P & W recommends sulphur-base cutting oils in preference to other types; also due to the unusual amount of heat generated in chip removal, they recommend provision for a heavy stream of the cutting fluid for cooling. We submit that this type of advertising message is a public service, deserving of credit to its originators.

Rough or Smooth

Evidently the battel of the "micro-inches" is on—at least it has made an appearance in a public forum. It all started with a behind-the-scenes announcement by one of the car producers. This manufacturer told in detail how his engineering department had decided, after much experimental testing, that the best service life fo crankshaft and connecting rod bearings and journals would be achieved by actually "roughening up" the pins and journals, yes, as much as 40-70 micro-inch finish instead of the usual 4 to 6 or 7 to 10. While this statement appears to be a violent contradiction of the practice in recent years, apparently the thus far anonymous producer has the facts to support his claim. Suffice it to say that the technique of surface finish has been a moot question for a long time. There has been tacit agreement on certain points; there has been emphatic disagreement on others. It is a fine thing for the industry that so controversial a question is finally out in the open for all to see—and to judge.

Superfinish Gears

Recent Chrysler exhibit had a fascinating tid-bit by way of an aircraft engine gear with the teeth Superfinished. We are told that the Superfinish department has been grooming a special machine for doing this job and that production equipment will be available in due time. This is a most interesting prospect, judging by the appearance of the gear that was on display. Super-finish produces a perfect surface finish of high polish, said to be of great value in the highly stressed aircraft gearing. In fact the process will be applied at the start on Chrysler airplane engine gears.

For Engineers

The fourth edition of the well-known Marks' Mechanical Engineers' Handbook is off the press, signalling a continuous service to engineers since 1916 when the first edition made its appearance. The current edition has been increased in size to 2276 pages, broadened in scope to encompass all of the manifold interests of the mechanical engineer. We understand that the new book is more than just a revised edition. Actually it has been largely rewritten and many of the sections are completely new.—J. G.

Automotive MATERIALS 55

Cold-Proof Neoprene

A NEW type of Neoprene synthetic rubber that withstands the effects of sub-zero temperatures better than other types has been announced by the Du Pont Company. Details regarding the new product were revealed in an American Chemical Society paper by D. F. Frazer and F. L. Yerzley at Atlantic City on Sept. 12. It combines the desirable qualities of natural rubber at low temperatures and the oil-resistant qualities characteristic of all types of neoprene. Up to the present, all known types of synthetic rubber invariably harden when exposed to extremely low temperatures. Neoprene Type FR, however, is as freeze-resistant as natural rubber, and at the same time oil-resistant.

In addition, the vulcanizates of Neoprene Type FR are more resilient, take lower compression set, and have greater resistance to swelling by water than those of other neoprenes. In respect to these properties it equals or even exceeds rubber itself. Like rubber, Neoprene Type FR requires sulfur to obtain an adequate state of cure in normal vulcanizing operations. Like other types of neoprene, Type FR has excellent flame-and sunlight-resistance. It is supplied in the form of preplasticized, milled sheets and has a lower specific gravity than any other neoprene—1.15.

Material of such characteristics if of great interest to the automobile and aircraft industries. For instance, on many automotive vehicles there are vacuum-operated diaphragms which must not stiffen at the lowest temperatures at which cars are being operated, about minus 40 deg. Fahr. Many of the new airplanes are designed to be operated at high altitudes where temperatures drop as low as minus 70 degs. In many of these applications the elastomer must possess excellent resistance to sunlight and oxidation, in addition to resistance to low temperatures and oils. Neoprene Type FR is said to meet these requirements.

Detergent for Acid-Pickling and Alkaline-Cleaning Baths

A SYNTHETIC detergent called Triton 720 and described as an aqueous paste of a sulfonate ether salt is announced by Rohm & Haas Co., Philadelphia. It is said to be useful in the annealing and electroplating fields where its stability makes it suitable for either acid pickling baths or alkaline cleaning solutions.

Triton 720 is said to disperse scum that forms on the top of acid pickling tanks, thus increasing the life of the acid and eliminating faulty cleaning. When it is added to the acid bath, a light foam forms on top of the tank and prevents disagreeable acid fumes from escaping. In alkaline cleaning solutions, concentrations of Triton 720 ranging from 0.1 per cent to 2 per cent of the weight of the bath are recommended, and are said to remove greasy film from metal and prevent precipitation of metal salts on the surface of the parts.

Alternate Zinc Die-Casting Alloys with Low Aluminum Content

UNDER the sponsorship of A.S.T.M. Committee B-6 on Die-Cast Metals and Alloys, a series of investigations has been under way looking toward the possible reduction in aluminum content from about 4 per cent to about 1.5 or 2.0 per cent in the widely-used zinc-base die-casting alloys Nos. XXIII and XXV. The two alloys most commonly used in the die-casting industry are ASTM alloys XXIII and XXV. The former is a zinc-base alloy containing 4 per cent aluminum and about 0.03 per cent magnesium, while the latter in addition has a 1 per cent copper content. Both alloys are compounded with high-purity zinc (99.99 per cent pure).

Preliminary results based on laboratory tests are now available, and some conflicting commercial experience has been reported in the use of such low-aluminum alloys. As regards laboratory tests, Apex Smelting Co. has reported a considerable amount of data from which is taken the following comparison of these two alloys:

	Al, per cent	Cu, per cent	Mg, per cent
A.S.T.M. alloy XXV	4.1	1.0	0.03
Low aluminum substitute	1.5	1.0	0.03

	Alloy XXV	Substitute Alloy
Tensile strength, as cast, psi	44,300	40,400
Tensile strength, 10-day, 95 C water vapor, psi	34,500	28,000
Elongation, as cast, per cent	5.3	5.7
Elongation, 10-day, 95 C water vapor, per cent	3.7	5.7
Charpy impact (avg. gate and vent) as cast, ft.-lb.	38.5	34.0
Charpy impact (avg. gate and vent) 10-day, 95 C water vapor, ft.-lb.	6.7	12.8
Dimensional change on 6-in. bar, 10-day, 95 C water vapor, in.	—0.0002	—0.0006

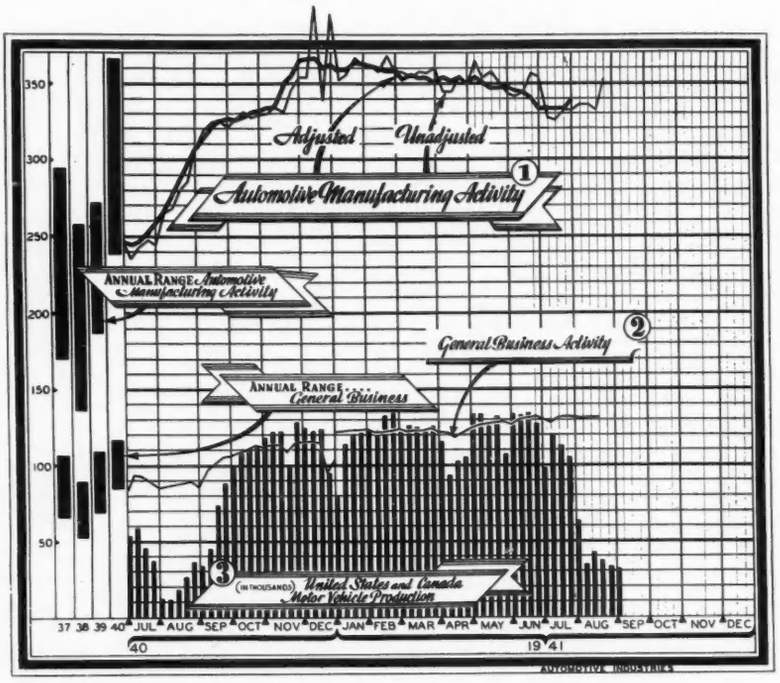
The New Jersey Zinc Co. reports that as far as their tests have gone, they have obtained substantial checks

(*Turn to page* 62, *please*)

WHAT THE INDUSTRY IS DOING

[*Our own view of automotive production and sales; authoritative interpretation of general conditions*]

Season Start Lacks Zest of Other Years



Weekly Indexes of Automotive General Business

PRODUCTION still was at a seasonally low level as the automobile manufacturers swung into September new car announcement season. Chrysler divisions and all the independents were nearing their fall peak output under the restricted quotas set by OPM, but General Motors and Ford were just getting under way by the middle of the month. With output frozen at the quota figure for the four months through November and most automobile shows cancelled, these manufacturers were in no hurry to introduce their new products and the haste of past seasons was missing.

Approximately 90,000 passenger cars and trucks were produced in the U. S. and Canada during the first half of September. This rate is expected to be accelerated sharply in the latter half of the month as the late starters get into production, but the month's total is unlikely to surpass the 284,583 units assembled in Sepember, 1940. This compares with production of 174,700 units in August, according to AMA estimate. Material shortages due to priorities and to strikes in the plants of suppliers already have curtailed output at several companies and the material situation may accentuate this condition during the coming weeks.

Output was estimated at 32,000 units for the week ending September 6 as Labor Day cut the work week to four days. The total climbed to approximately 47,000 vehicles for the week ending September 13. With all General Motors divisions but Cadillac in '42 model production, GM accounted for 9000 assemblies in the latter week. Chrysler turned out 18,600 units and Ford, just getting into the '42 model run, produced 4500. Hudson topped the independents, followed by Nash, Studebaker, Packard and Willys.

Prices reported on 1942 models show increases of 15 to 25 per cent over the prices that prevailed at the start of the 1941 model run. These include the expected boost in the Federal excise tax from 3½ to 7 per cent. All companies but GM raised their prices last spring following increased labor and material costs. Other adverse cost factors on the new cars are the higher cost of alternate materials necessitated by the defense program and the smaller total output which must carry factory overhead costs. Price raises have received the tacit approval of Leon Henderson, OPA head.

Probably anticipating the higher prices, retail sales of passenger cars in the U. S. during July climbed 16 per cent to 345,841 units, according to the AMA, while commercial vehicle sales were up 43 per cent to 85,623 units. This reduced new passenger car inventories with U. S. dealers to 145,840 vehicles on August 1, 24 per cent less than on the same date in 1940.

The inventory situation is revealed by the fact that GM retail sales during August dropped to 84,969 units, a decline of 16 per cent from the 100,782 units delivered to customers in August, 1940. Many dealers had exhausted their stocks. This is the first time that GM retail sales have dropped below the same month of the previous year since Oct., 1938. This trend will become increasingly evident as the effects of curtailment are felt in months to come.

Despite the GM sales decline, new passenger car registrations for August showed an increase of 25 per cent over the same month of 1940, based on reports from 112 principal cities for the first 24 days of the month to R. L. Polk & Co.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. of New York to Jan. 1, 1941, and *New York Times* weekly business index after that date; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Knudsen Explains Relation Of SPAB, OPM and Industry

Due to Materials Problem, Production Quotas Will Have To Be Set on Month-to-Month Basis; Automobile Section Remains

Monthly quotas for automobile production will be worked out through the OPM Industry Advisory Committee under the reorganized defense program, which will operate under the direction of the Presidentially-established seven-man Supply Priorities and Allocations Board, according to OPM Director General William S. Knudsen. Mr. Knudsen, who was also made a member of the board, explained that it will deal with materials necessary for automobile production. There was an implication that quotas under the curtailment policy may be affected more than was originally contemplated because of the situation relating to supplies.

"A certain amount of material is required," said Mr. Knudsen, "and if we do not have it then we will talk to the board regarding a change in the quotas."

Asked if the monthly quotas will be worked out by the Industry Advisory Committee, Mr. Knudsen replied that everything under the program is worked out through that committee.

"We now have them all in one place," Mr. Knudsen continued, as he expressed that opinion that by bringing together OPM and OPACS—now called OPA, Office of Price Administration—the two agencies can speed up their work. It was pointed out by Mr. Knudsen that the Civilian committees, the Army and Navy committees and the OPM committees now are interlocking and "material will be all in one place."

Reshuffling will take place all the time, Mr. Knudsen said, adding that as requirements go up a shift will be made from civilian to military demands, "and we might set a minimum with which civilian allocations could get along."

Management Problem

Mr. Knudsen was asked if he felt that civilian economy must have certain minimum requirements to prevent its going to pieces. The observation was made that "if it goes to pieces, so does your defense program."

"Well, I feel that this is a job of management—above all, management of the available material in the United States," Mr. Knudsen responded. "We will have to do the very best we know to get along with the defense program and with the least dislocation of civilian industry. But we know that there is going to be such dislocation."

"Well, there won't be business as usual or better than usual, will there?"

"No, it couldn't be," Mr. Knudsen said. "You can't fight a war on a limited week. You have to put everything into it—on a limited supply."

More Shifts and Employment

Mr. Knudsen's remark about a limited week was supplementary to a previous statement that OPM is working up to more shifts. He cautioned that it must be remembered that the increase in employment and you can't merely put men into place. "It is necessary," he declared, "to see that they have somebody looking after them, materials and tools with which to work."

Mr. Knudsen was asked if he thought SPAB would be in a position to tell the automobile industry that it can have materials sufficient to take care of schedules set up for it.

"We don't even do that," he replied. "We don't guarantee that. We only do that from month to month."

Queried whether materials could be

(*Turn to page 52, please*)

Henderson Gets Say-so On Automotive Production

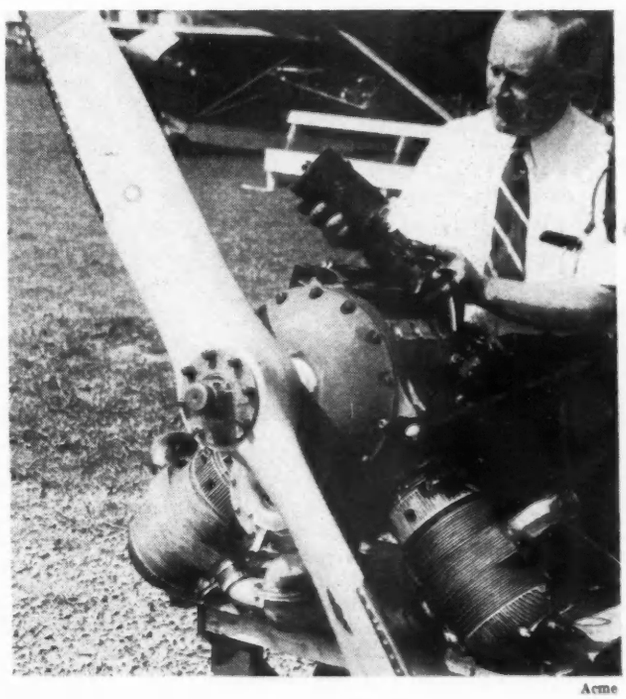
Leon Henderson, who as OPACS Administrator clashed for several weeks with OPM over the extent of automobile production curtailment, has been given jurisdiction over OPM's Automotive and Transportation Equipment Branch, which has been placed in the OPM Civilian Supply Division headed by him.

When President Roosevelt reorganized the defense machinery a few weeks ago, and attempted to bring an end to a jurisdictional dispute brewing between OPM and OPACS, He made Mr. Henderson head of a new Civilian Supply Division in OPM. On Sept. 10, OPM Director General William S. Knudsen announced a rearrangement of various industrial branches made necessary by the establishment of the new Civilian Supply Division, and placed under Mr. Henderson's wing the Automotive and Transportation Equipment Branch and seven other industrial groups. OPM officials said that all automotive products will be handled by Mr. Henderson, including production quotas, but that military vehicles will continue to be under the jurisdiction of the Production Division. Mr. Henderson also is OPA Administrator, which position gives him jurisdiction over automobile prices.

James S. Adams resigned recently as head of the Automotive and Transportation Equipment Branch to return to Colgate-Palmolive-Peet Co. His successor was not named up to press time.

Double Acting

One lb. per hp. is the approximate specific weight (without generator and starter) of this double - acting, valveless airplane engine, which has been developed by Harry Hedges at Hightstown, N. J. Its two cylinders generate 130 hp. Bore and stroke are 4 in. by 4 in. and the compression ratio 5.9. The cast aluminum cylinders have nickel cast iron liners. Flight tests are said to have been quite successful.



Acme

America's Largest Plane Plant

Curtiss-Hawk P-40 pursuit fuselages shown near completion in Curtiss-Wright's new Buffalo factory. America's largest, it has a total area of 1½ million square feet and cost $18 millions to build.

Ford Has Orders for 9043 P & W 2000-Hp. Engines

Production Starts at New Factory Toward 40-per Day Goal; Defense Activity Is Increasing Fast at Automobile Plants

Ford Motor Co. now is in aircraft engine production with the turning out of one 2000-hp. Pratt & Whitney 18-cylinder engine per day during early September at the new Rouge plant. First of the Double Wasp engines came off the line August 17, just a year from the date that Ford officials visited the Pratt & Whitney plant at East Hartford, Conn., to study production methods. The one-a-day output was begun September 2 and gradually will be increased to an ultimate goal of 40 engines per day. Production is expected to reach at least 300 engines per month by January 1.

Ford orders for the 2000-hp. engine total 9043 valued at $261,134,759. Aircraft engine building, an air-conditioned "blackout" type factory, was begun Nov. 24, 1940. When the original order was increased, an addition was made to the rear of the building and this is nearing completion. The enlarged building will be 360 x 1400 ft. and will have approximately 1,300,000 sq. ft. of floor area. Employment will exceed 15,000 men when full production is reached. The Double Wasp engines are used to power medium bombers like the B-26, fighter planes and naval patrol bombers such as the Consolidated Catalina flying boats.

Ford engineers also are working on plans for the B-24D four-engined Consolidated bombing plane which will be produced in the huge $47,000,000 plant now under construction at Willow Run. Jigs and fixtures have been set up in a building at the Ford airport which once housed the manufacturing activities of the Ford tri-motor plane. It is planned to produce the first 10 bombers in this plant before the Willow Run plant is ready for occupancy next spring. Ford draftsmen also are busy in one of the airport hangars breaking down construction on the 20-ton plane to 80 major assemblies.

Chrysler Corp., which will undertake to supply the nose and center fuselage sections for the Martin B-26 bomber, has devoted 2,000,000 man-hours of toolroom work to get its plants ready for this defense project. These two sections of the bomber fuselage weigh 4800 pounds, are 33 feet long and contain 11,500 component parts compared with a Plymouth four-door sedan, which weighs 976 pounds, is 11 feet, five in. long and contains 2500 parts. The two bomber subassemblies require 54,000 rivets and contain 85 per cent aluminum, as well as 60 pounds of magnesium, 50 pounds of copper and 400 pounds of aluminum alloys.

Chrysler Supplying Parts

Many Chrysler divisions will supply bomber parts. Stampings are being made at the Highland Park and De Soto divisions, rough aluminum forgings at the Dodge Division, which also will supply Goodyear, Hudson and Martin; machinery work and the bomb rack at the Airtemps Division in Dayton, Ohio, and bearings and bushings at the Oilite Division. Chrysler even will supply the armored seats and instrument panels. Five hundred subcontractors are helping out on the bomber job.

Quantity production has been reached at the Chrysler Tank Arsenal, which is turning out the heavily armored 28-ton vehicles at a rate in excess of five per day. Three parallel assembly lines are working on the tanks in the huge arsenal, where ground was broken on

(*Turn to page 50, please*)

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

Horace Shankland, a director of the Dunlop Rubber Co., has been elected president of the Society of Motor Manufacturers and Traders. Shankland, who is a member of the Institute of Transport, has been connected with the tire industry for over 40 years, joining the Dunlop Co. when the latter absorbed the firm of Macintosh and Co.

* * *

Additional prominent members of the automobile industry have recently been appointed to direct the drive for still further increase in airplane production. Among them is Capt. J. P. Black, managing director of the Standard Motor Co.

* * *

Joseph Lucas and Co., the biggest automobile accessory manufacturers in Britain, controlling the English Bendix Co. and several other concerns, has temporarily lost the full-time services of its two managing directors. Oliver Lucas has been appointed Adviser on Development and Design to the Minister of Supply, Lord Beaverbrook, while his colleague, Sir Peter Bennett, besides having been elected recently a Member of Parliament, has just been appointed chairman of the Automatic Gun Board.

* * *

Substantial reductions have been made in the quantity of gasoline allowed to motor traders for their use in the collection and delivery of new and used cars and trucks they may buy and sell, and for road-testing customers' vehicles after repair. The Petroleum Department has apparently decided that dealers must henceforth restrict the range of their activities in the purchase and sale of used cars and trucks to a radius of 50 miles from their premises.

* * *

The basic gasoline ration for coaches and buses is to be withdrawn, and fuel allotments will be granted for essential passenger services only. This means the putting out of business of innumerable small firms and individuals operating coaches on pleasure trips, though on a very small scale since the outbreak of war, and will put a stop to long-distance bus services competing with the railroads, such as those that have been running for 15 years or so between London, Glasgow, Bristol, Birmingham, and other cities.

CALENDAR

Conventions and Meetings

Natl. Petroleum Assoc., Atlantic City, Sept. 17-19

Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26

Natl. Lubricating Grease Inst., Chicago, Sept. 29-30

Natl. Safety Council, Chicago.....Oct. 6-10

Exposition of Power & Mechanical Engineering, Chicago .....Oct. 6-11

Amer. Society of Tool Engineers, Toronto, Canada .....Oct. 16-18

National Metal Congress and Exposition: Cooperating societies—American Society for Metals, Wire Association, American Welding Society, Institute of Metals and Iron and Steel Divisions of American Institute of Mining and Metallurgical Engineers, Philadelphia .....Oct. 20-24

SAE Natl. Fuels & Lubricants Mtg., Tulsa, Okla. .....Oct. 23-24

Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles .....Oct. 30-Nov. 1

SAE West Coast Transportation Mtg., San Francisco .....Nov. 5-6

SAE Natl. Transportation & Maintenance Mtg., Cleveland.....Nov. 13-14

National Assoc. of Manufacturers, New York City .....Dec. 3-5

Natl. Automobile Dealers Assoc., Chicago .....Jan. 20-21

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

General business activity has remained approximately stable. The seasonally adjusted index of *The New York Times* for the week ended August 30 stands at 130.5 per cent of the estimated normal. That is three fractional points below the figure for the preceding week. The index of *The Journal of Commerce*, without adjustment for seasonal variation, for the same period declined to 125.6 per cent of the 1927-29 average, as against a peak of 126.1 for the week before and 108.4 a year ago.

Department store sales during the week ended August 30, according to the Federal Reserve compilation, were 29 per cent above the comparable total last year, as against a similar gain of 18 per cent for the current year to date.

Contracts awarded for heavy construction during the week ended September 4, reflecting the influence of a holiday, declined to $90,014,000 from $124,233,000 a week earlier, according to *Engineering News-Record*. The 1941 total to date, $4,420 millions, is double the corresponding amount last year.

Railway freight loadings during the week ended August 30 totaled 912,720 cars, 1.4 per cent more than in the week before and 18.7 per cent above the comparable number last year.

Electric power production increased contra-seasonally in the same period and was 17.8 per cent greater than the output a year ago.

The number of business failures during the week ended August 28 was 200, as compared with 227 in the preceding week and 229 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended August 30 averaged 4,004,700 barrels daily, a new peak. This was 29,250 barrels more than the average a week earlier and 64,700 barrels above the currently required output as computed by the Bureau of Mines.

Average daily production of bituminous coal for the same period was 1,817,000 tons, as against 1,792,000 tons in the preceding week and 1,517,000 tons a year ago.

Cotton mill activity was unchanged in the week ended August 30, *The New York Times* adjusted index remaining at 165.5 per cent of the estimated normal, as compared with 124 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended September 6 stands at 97.9 per cent of the 1926 average, as against 97.7 for the week before and 82 a year earlier.

Member bank reserve balances declined $114 millions during the week ended September 3, and estimated excess reserves fell $130 millions to a total of $4,860 millions.

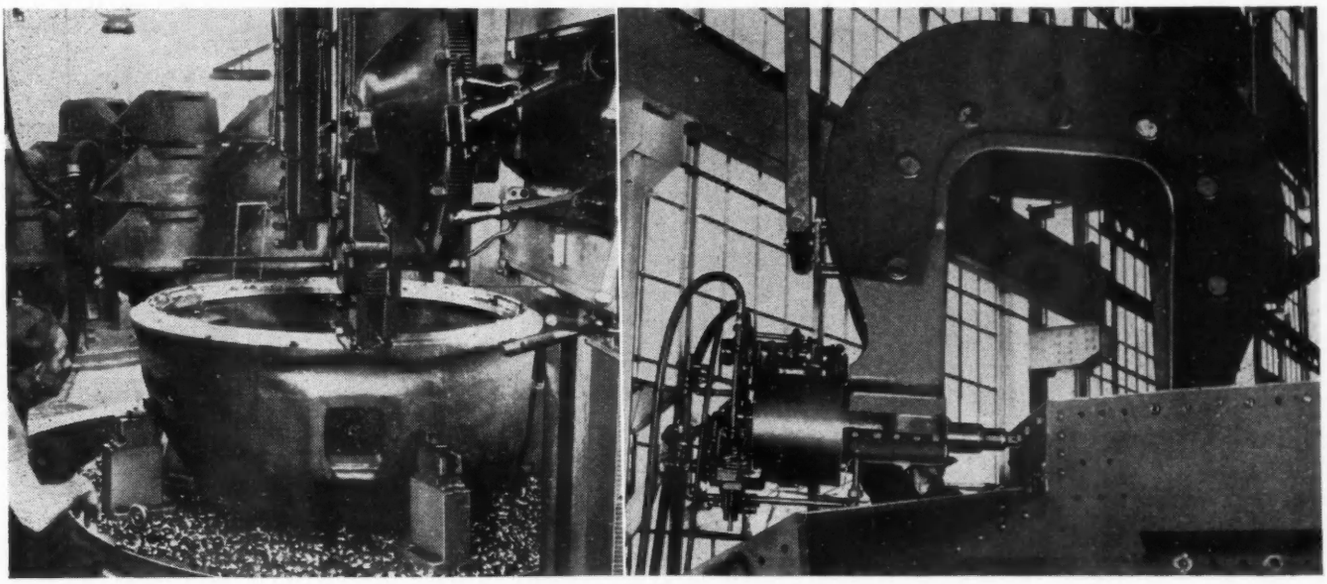
Industry Payroll 2¼ Billion

Employment of 1,561,309 persons with an annual normal payroll of $2,212,954,348 is provided by the manufacturing, wholesale and retail activities of the automotive industry, combined with the retail and wholesale distribution of petroleum products, according to a survey by the U. S. Census Bureau.

Mobile Surgical Hospital Authorized for Army

Mobile surgical field hospital units with self-contained operating facilities have been authorized for purchase by the War Department.

Seven of the fourteen vehicles in each hospital-on-wheels comprise the operating group, designed and equipped to handle 80 major operations each 24 hours. Each unit will have the following vehicles in its train: one ½-ton truck for command; two 2½-ton trucks for mounted power plants of 35 kilowatts each; two 2½-ton cargo trucks; two 2½-ton 6-wheel drive water tank trucks. Seven special vehicles containing: four operating rooms; one sterilizing room; one X-ray room; one medical supply and office.



Power Tools Speed Tank Production

Above left: This queer-looking kettle is really a 4000 lb. turret casting being machined for the Army's M-3 medium, 28-ton tanks at Chrysler's tank arsenal in Detroit. Above right: A power riveter to cold rivet the M-3 medium tanks. These riveters weigh more than 4 tons each and have a squeezing pressure of more than 100,000 psi.

Plan to Protect Seniority Rights of Defense Workers

OPM and Manufacturers Tentatively Agree at Detroit Meet; Ford Makes First Union Dues Payment in Check-Off System

Protection of seniority for workers who transfer from a consumer industry, such as the automobile industry, to a plant engaged in national defense work, was tentatively agreed upon at meetings between officials of the OPM and the automotive manufacturers at Detroit early in September. When a worker is laid off in a non-defense plant, he will not surrender his seniority by taking a post in a defense plant. He can re-establish that seniority when he returns to work at the old plant upon resumption of production there. Workers with seniority also will be given preference on defense jobs with the same company, other things being equal.

Where the choice lies between a worker who is skilled in the type of work which the defense job demands, and the veteran worker with seniority who has not had experience in that type of work, the matter will be left to negotiation between the company and the union representatives.

Officials at Meeting

Attending the Detroit session were Eric Nichol, assistant chief of the Labor Supply Section of the OPM, Frank McSherry, Coordinator of the National Defense Training, Eli Oliver, Chief of OPM Labor Relations, President R. J. Thomas, Walter Reuther and Richard Frankensteen of the UAW-CIO, H. W. Anderson of GM, Robert Conder of Chrysler, Harry Mack of Ford, and other industrial relations representatives.

Wendell Lund, Director of the Michigan Unemployment Compensation Commission, estimated that 125,000 industrial workers have been transferred to defense jobs in Michigan. He estimates there are 398,000 industrial workers in the state, of which 251,000 are automotive. Estimates of the number who will be made idle by the curtailment in automobile production before defense plants can take up the slack range between 50,000 and 100,000 men.

August Employment

August employment figures failed to reflect any effects of curtailment, factory workers in Wayne County, Detroit numbered 366,000 on Aug. 15, a gain of 11 per cent since July 31, and 19 per cent greater than the same date in 1940. Applications for job insurance benefits dropped to 84,747 for the last week in August, a decrease of 23 per cent from the previous week's peak of 109,706. The Michigan unemployment compensation fund now totals $112,000,000 and is believed able to withstand the shock of increased benefits due to layoffs from the automobile curtailment program.

In the first payment of union dues under the checkoff system, Ford Motor Co. sent a check totaling $132,224 to the UAW-CIO representing initiation fees and union dues for August. The biggest total, $87,378, was collected from Rouge Plant workers, while $7,080 came from Edgewater, N. J., $6,447 from Chicago and $5,349 from Chester, Pa. Receipts from 26 plants were recorded. No reductions were made from plants in Charlotte, N. C., Cleveland, Jacksonville, Fla., Oklahoma City, Cincinnati and Seattle because they were not approached by the union.

The NLRB recently conducted a Detroit hearing on the application of the UAW-AFL to be certified as collective bargaining agent for 3,000 workers in the Ford Village Industries, small plants located in 14 southwestern Michigan towns. Ford attorneys stated that they understood that the contract signed with the UAW-CIO covered all Ford workers in the country.

Only other large plant to grant the union shop and check-off in the automotive industry since Ford's signing, has been Murray Corp. of America. The Murray contract runs until Jan. 1, 1943.

In the first NLRB poll to be held at an exclusive defense plant, workers at the Chrysler tank arsenal voted 1645 to 95 for the UAW-CIO in an election Sept. 4. No other union was on the ballot. Sixty-five per cent of the 2684 employees voted. The Society of Designing Engineers (CIO) won two NLRB elections at Chrysler plants, carrying the Dodge division drafting room, 56-11, and the Highland Park plant, 62-19.

Twenty-two Hudson dealers in the Detroit area have signed contracts with the Auto Salesmen's Local, CIO. Fifty-four Ford dealers in metropolitan Detroit have signed up union shops for their service departments and are expected to do likewise with the salesmen's local.

Toledo's last unorganized major plant fell to the UAW-CIO Aug. 25, when employees of the Champion Spark Plug Co. voted 650 for the UAW and 466 for no union.

Analyzing Machine Vibrations

Latest version of portable dynetric balancer without amplifier is used at Westinghouse's East Pittsburgh Works to analyze vibrations of machines at speeds up to 7500 r.p.m. It determines the amount and location of any unbalance.

Armament Exhibit At Buffalo Auto Show

An exhibition of defense products, the largest of its kind ever assembled, in Buffalo, will be an outstanding feature of the 40th annual Buffalo automobile show in Memorial Auditorium October 11-18. All types of bombs, shells, tanks, anti-aircraft guns, pursuit planes and bombers will cover the entire floor of the auditorium.

The association this year will give away defense bonds as prizes for patrons instead of the usual free automobiles. First prize will be a defense bond worth $1000, the second $500 and the remaining bonds $100 each.

Roger D. Howell

Roger D. Howell, assistant plant superintendent of Bliss & Laughlin, Inc., died recently of a heart attack at Harvey, Ill., at the age of 64. He had been with the company for the past 20 years.

Passenger Car and Truck Production

(U. S. and Canada)

	July 1941	June 1941	July 1940	SEVEN MONTHS 1941	SEVEN MONTHS 1940	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	335,884	408,424	165,672	2,703,313	2,124,820	+27.3
Foreign Market—U. S.	7,884	10,559	3,097	68,037	71,379	− 4.5
Canada	3,849	8,538	3,397	69,048	75,683	− 8.7
Total	347,597	427,521	172,166	2,840,398	2,271,882	+25.0
Trucks—U. S. and Canada						
Domestic Market—U. S.	83,916	86,009	53,074	575,125	388,027	+48.0
Foreign Market—U. S.	16,439	15,533	9,860	93,510	76,005	+23.0
Canada	20,805	17,215	11,071	108,477	49,697	+118.1
Total	121,160	118,757	74,005	777,112	513,729	+51.7
Total—Domestic Market—U. S.	419,800	494,433	218,746	3,278,438	2,512,847	+30.4
Total—Foreign Market—U. S.	24,303	26,092	12,957	161,547	147,384	+ 9.8
Total—Canada	24,654	25,753	14,468	177,525	125,380	+41.8
Total—Cars and Trucks—U. S. and Canada	468,757	546,278	246,171	3,617,510	2,785,611	+30.0

New Regulations Favor Sub-Contracting

In line with the Administration's effort to extend the practice of sub-contracting defense work and bring more industrial plants into the defense picture, the War Department has acted to liberalize its procurement methods by permitting prospective government contractors to negotiate with the Army either individually or in groups, authorizing awards at prices up to 15 per cent above the lowest bid, and eliminating performance bonds when necessary. Also under its provisions, contracting officers are authorized to divide awards so that parts of an order can go to several instead of to single low bidders.

Sub-contracting within their own region also will become mandatory upon nearly all prime contractors under another provision adopted in the new regulations. This requirement is designed to permit other industries in the vicinity of a prime contractor to "take up a share of the defense load" and afford protection to plants suffering from lack of civilian contracts.

ADVERTISING

Maxon, Inc., has been awarded the advertising accounts of the truck and service, parts and accessories divisions of the Ford Motor Co. W. G. Eversman, one-time advertising and sales promotion manager for Reo and more recently with the H. G. Heinz Co., is Maxon's executive on the truck account.

Holden, Stedman & Moore is the new name of the Detroit advertising agency formerly known as Holden, Graham & Clark, Inc. Parker Holden continues as president. Other partners are Gerald Stedman, formerly with C. C. Winningham, Inc., as vice-president, and Lansing Moore.

Gray & Rogers, Philadelphia advertising agency, will direct advertising, promotion, and merchandising for the Wilkening Mfg. Co. Mr. Sherman G. Landers will contact the account.

Rubber Advisory Committee Appointed

Members of a five-man sub-committee on labor problems appointed under the OPM rubber defense industry advisory committee are: Fred Climer, Goodyear Tire & Rubber Co.; H. B. Spencer, United States Rubber Co.; Harold B. Leland, Hood Rubber Co.; J. H. Matthews, Raybestos-Manhattan Co., and J. F. Joseph, Cincinnati Rubber Mfg. Co.

Army Orders Tank Engines

The Curtis-Wright Corp. has received from the Army an order for Whirlwind aircraft engines to power the Army's M-3 medium, 28-ton tanks. The engine has a displacement of 975 cu. in. and is only 45 in. in diameter.

Trucks Paying Heavy Taxes

Taxes on motor trucks will total $475 millions in 1941, according to present estimates. This is more than double the $231,730,000 collected from trucks in 1931.

More Gas and Oil

Four times as much crude oil is processed and nine times as much motor fuel is made today in the United States as in 1917, the year the United States entered the World War.

Celebrates Fiftieth Year

Last week the Chain Belt Co., Milwaukee, Wis., celebrated its fiftieth anniversary. Organized in 1891 (its advertising appropriation was $10.50) for production of a detachable chain for use on farm machinery, activities of the company gradually expanded to include production of a line of elevators and conveyors, construction machinery, sewage disposal and water treatment equipment and special belts and conveyor systems for the automotive industry.

PUBLICATIONS

Young Radiator Co.'s new Catalog No. 2541 illustrates its **Vertiflow units** in many models and sizes. It also contains complete engineering information.*

The August issue of Wil-Rich Forum, published by Wilcox-Rich Division of Eaton Mfg. Co., contains an article on **valve design** as a controlling factor in internal combustion engine development.*

Durex Iron is the title of a booklet issued by the Moraine Products Division of General Motors Corp. It described powder metallurgy as a practical answer to the production of bearings, gears and cams and miscellaneous metal parts.*

Symposium on Color, Its Specification and Use in Evaulating the Appearance of Materials is the title of a booklet published by The American Society for Testing Materials, Phila., Pa. It is priced at $1.00 per copy.

The Wings of Mercury, an attractive booklet by The Mercury Corp., describes and illustates its **battery testing equipment.***

A new booklet by D. A. Stuart Oil Co., Ltd., discusses the subject of **metal cutting lubricants** and recommends the solutions to many difficult application problems.*

Individualized Inco Nickel Alloys, a new booklet by International Nickel Co., gives individual characteristics, mechanical properties and application information on **the Inco Nickel Alloys.** Tables of physical constants and available forms are included.*

The Delta Mfg. Co.'s booklet, New Wings for Production, emphasizes the adaptations of the new type low-cost **precision machines** to meet the urgent needs of the rapidly expanding aircraft industry.*

Whitman & Barnes has just announced a new catalog, No. 7, which illustrates and lists all types of **drills, reamers, counterbores, screw extractors, interchangeable punches,** etc. It also contains valuable information regarding the design, construction, use and care of drills, and reamers.*

Aluminum Service Bulletin, published by Aluminum Co. of America, contains selected references on aluminum for the national defense industries. Approximately 100 articles and booklets are listed in the service.*

A new condensed catalog, describing its entire line of **lathes,** has just been issued by South Bend Lathe Works. The condensed data includes illustrations, basic dimensions, capacities, speeds and feeds of backgeared, screw cutting lathes.*

The current issue of **Steel Horizons,** house organ of Allegheny Ludlum Steel Corp., contains an interesting, illustrated article on the Sperry Gyroscope.*

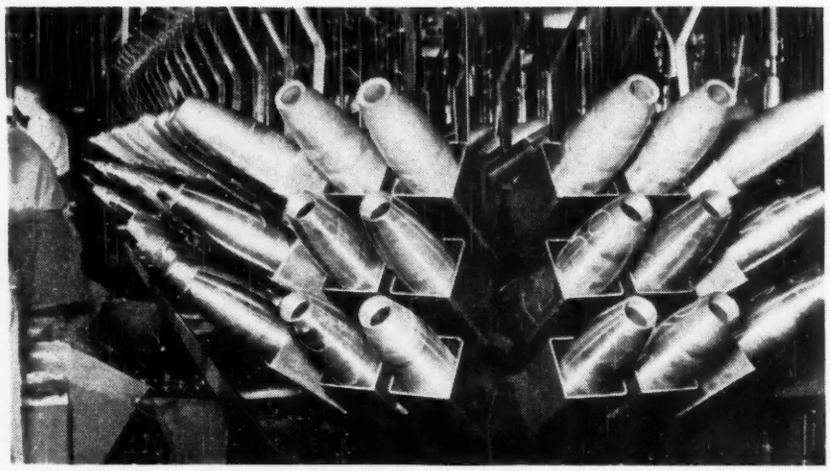
New Westinghouse literature is as follows: Bulletin describing **miniature panel instruments;** booklet on **air-cooled transformers;** leaflet describing **voltage relays;** a leaflet on **lightning arresters for voltage regulators** and a bulletin describing **Flexarc A-C Welders.***

The current issue of Thiokol Facts, published by Thiokol Corp., contains data on the use of **synthetic rubber** in defense.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Retreading on Up-Grade

Figures just compiled by the Rubber Mfrs. Association indicate approximately 4500 retreading plants in the United States are doing an annual volume of $45 million. The phenomenal growth of this business is attributed mainly to the constant effort of fleet operators to reduce tire maintenance costs.



Conveyor Speeds Production

105 and 75 mm. shells shown on a monrail conveyor in GM's forge plant. To-date, $7 millions worth have been delivered by GM. About $1200 millions more are yet to come.

MEN . . . . . .

Dr. Thomas Midgley, Jr., vice-president of Ethyl Gasoline Corp., and inventor of anti-knock gasoline and chemical refrigerants, was the recipient of the Priestly Medal, Sept. 8, at the American Chemical Society's convention in Atlantic City.

C. G. Taylor, former president of Taylorcraft Aviation Corp., has resigned to become board chairman, succeeding **James S. Ogsbury,** president of Fairchild Aviation Corp., who resigned because of the press of other duties. The presidency of Taylorcraft will be left vacant.

Philip J. Burns has been named public relations director for Oldsmobile. He formerly was in charge of General Motors public relations in Flint.

Courtney Johnson, assistant sales manager of Studebaker's passenger car division, has been transferred to the company's Washington office to concentrate on defense activities.

George E. Smith, vice-president of the Crosley Corp., has been retained as civilian advisor and counsellor on the reorganization of certain activities of the U. S. Army Signal Corps by Brig.-Gen. Dawson Olmstead, new chief signal officer.

Ben B. Settle has been appointed director of service of the Dodge organization, a vacancy occasioned by the death of Walter R. Bamford.

New General Motors appointments are as follows: **L. C. Goad** becomes assistant to Albert Bradley, vice-president in charge of the car and truck group; **F. L. Burke,** assistant to W. C. Williams, Jr., vice-president in charge of the accessory group; **C. A. Michel,** general manager of the Guide Lamp Division; and **H. W. Anderson,** general assistant to B. D. Kunkle, vice-president in charge of the personnel staff.

Donald N. McDonnell, vice-president of Blythe & Co., New York investment bankers, has been elected a director of Vultee Aircraft, Inc.

V. A. Dupy, central sales manager of United Motors Service, has been promoted to general merchandising manager, succeeding M. D. Hill, resigned.

E. V. Blake, eastern manager, has been appointed defense co-ordinator and **J. V. Van Buskirk,** formerly in the sales department, head the priorities division of the Belden Manufacturing Co.

Creation of an Industrial Relations Department with **James Leslie Goddard** as manager has been announced by the Plomb Tool Co.

A. C. Berg has been placed in charge of manufacturing for the Road Machinery Division of Gar Wood Industries, Inc.

L. W. Wallace, research and management engineer, has joined the staff of Trundle Engineering Co. as vice-president.

Dr. Edward E. Minor, Jr., research and development engineer of Glenn L. Martin Co., has been elected chairman of the committee on air transportation of the American Institute of Electrical Engineers.

Clarence E. Scott has been appointed sales manager of the Air Conditioning Division of Fedders Mfg. Co., Inc.

Fred H. Haggerson, vice-president of the Union Carbide and Carbon Corp., was recently elected a director of the company.

H. L. Powell has been appointed manufacturers' representative in the Milwaukee area for Goodyear Tire & Rubber Co.

Hobart Brothers Co., Troy, Ohio, announce the appointment of **John L. Foley** as its distributor for arc welders and supplies in the Buffalo territory.

H. N. Hawkes was recently made general sales manager of United States Rubber Company's tire division in charge of all tire sales; **H. E. Malcomb** was named his assistant. **R. P. F. Liddell** has been placed in charge of the airplane tire activities.

Harvey C. Tafe, general manager of the Nashville branch of Vultee Aircraft Corp., is returning to the Downey California plant to assume new duties assigned to him at the Pacific Coast plant; manufacturing operation at the factory will be under **Robert McCulloch,** recently appointed works manager.

Paul V. Osborn, former vice-president of the Carrier Corp., has joined the Timken-Detroit Axle Co. as assistant to the vice-president.

D. G. Baxter has been appointed general superintendent in charge of the Copperweld Steel Company's Warren, Ohio, plant.

Conveyor System for Bell Aircraft

Bell Aircraft Corporation has constructed a 5000-foot conveyor system to speed production in the Buffalo plant. The conveyor will service 24 "stations" in the plant through 170 metal baskets, each capable of carrying 100 pounds of material. It will move at a rate of about 40 feet per minute.

New Passenger Car Registrations

	JULY 1941	JUNE 1941	JULY 1940	SEVEN MONTHS 1941	SEVEN MONTHS 1940	Per Cent Change, 7 Months, 1941 over 1940	Per Cent of Total Seven Months 1941	Per Cent of Total Seven Months 1940	TEN MONTHS MODEL YEAR 1941	TEN MONTHS MODEL YEAR 1940	TEN MONTHS MODEL YEAR Per Cent Change
Chevrolet	95,110	103,324	77,374	691,587	534,949	+ 29.2	21.22	25.11	923,888	744,515	+ 24.1
Ford	65,485	71,586	54,791	448,027	350,823	+ 28.0	15.69	16.47	592,812	495,194	+ 19.8
Plymouth	45,758	54,601	41,682	350,529	282,022	+ 24.1	12.28	13.24	457,143	359,597	+ 31.0
Buick	33,383	37,569	25,304	243,298	169,731	+ 43.0	8.52	7.97	332,311	217,845	+ 31.0
Pontiac	28,895	33,168	21,033	223,839	149,597	+ 50.0	7.84	6.60	295,414	199,613	+ 48.0
Oldsmobile	24,624	27,332	17,199	184,112	120,673	+ 53.2	6.45	5.67	244,369	174,195	+ 40.0
Dodge	21,213	24,566	19,285	158,097	132,312	+ 19.5	5.54	6.21	201,755	166,451	+ 21.0
Chrysler	14,874	17,531	9,262	109,977	63,430	+ 74.0	3.85	2.98	137,579	79,499	+ 73.0
Studebaker	13,051	13,968	9,375	80,056	62,256	+ 28.6	2.80	2.92	106,974	89,430	+ 19.8
De Soto	9,184	11,254	7,215	66,930	45,021	+ 48.6	2.34	2.11	81,849	56,889	+ 49.2
Nash	7,563	10,228	4,937	61,596	33,988	+ 81.3	2.16	1.60	74,721	48,658	+ 53.5
Mercury	8,704	10,045	8,045	61,422	52,502	+ 16.9	2.15	2.46	81,018	74,520	+ 8.8
Hudson	6,319	8,232	5,544	52,150	46,895	+ 11.2	1.83	2.20	72,541	71,065	+ 2.0
Cadillac	6,970	7,105	2,818	46,196	20,819	+122.0	1.62	.98	60,075	32,085	+ 87.7
Packard	5,922	7,734	6,439	45,112	43,887	+ 2.9	1.58	2.06	63,656	65,601	- 3.0
Willys-Americar	2,415	2,637	2,069	15,666	13,276	+ 18.0	.55	.62	20,511	19,184	+ 7.0
Lincoln	1,962	2,292	2,100	13,745	13,003	+ 5.8	.48	.61	19,208	18,855	+ 2.0
Graham	31	40	258	492	882	- 34.3	.02	.04	1,023	1,195	- 14.3
Crosley	120	108	13	447	257	+ 74.0	.02	.01	558	392	+ 42.3
Bantam	9		72	90	584	- 84.6		.03	189	816	- 76.8
Miscellaneous	203	150	431	1,490	2,153	- 30.6	.06	.11	2,636	2,760	- 4.7
Total	391,795	443,470	315,246	2,854,858	2,130,060	+ 34.0	100.00	100.00	3,783,233	2,945,359	+ 28.2
Chrysler Corp.	91,029	107,952	77,444	685,533	522,785	+ 31.3	24.01	24.54	891,326	659,436	+ 35.3
Ford Motors	76,151	83,923	64,936	523,194	416,328	+ 26.5	18.33	19.55	693,038	588,569	+ 18.0
General Motors Corp.	188,982	208,498	143,728	1,389,032	986,769	+ 41.0	48.66	46.33	1,856,057	1,398,253	+ 32.9
All Others	35,633	43,097	29,138	257,099	204,178	+ 42.5	9.00	9.58	342,812	239,101	+ 14.8

Molybdenum steels give the required physical properties in heavy sections at reasonable cost

In big hoists enormous loads are applied frequently and suddenly to the heavy-sectioned drum shafts.

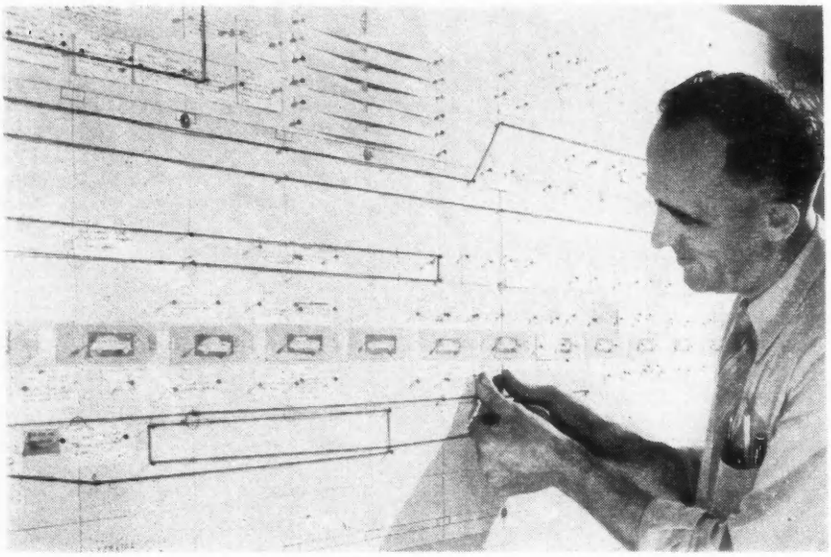
One manufacturer of such equipment makes his shafts of Chromium-Molybdenum (SAE 4140) steel. Even in the 4 to 9 inch sections used, the steel develops the requisite fatigue strength and toughness. And, since it machines well at the specified hardness (250 B.H.N. min.), the shafts can be bought in the heat treated condition and simply finished in the user's shop — an important economy.

Write for our free technical book, "Molybdenum in Steel".

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY



Templet Assembly Line Layout

Cadillac devised this system for working out production problems on a templet layout. Now management can tell at a glance how assembly manpower should be distributed.

Canadian Car Production Restricted to 44% of 1940

C. D. Howe, Canadian Minister of Munitions and Supply, has announced an Order-in-Council curtailing automobile production for 1942 to approximately 44 per cent of the 1940 figure. The following estimated savings in materials may be effected as a result of the new curtailment: cast iron and malleable, 10,040 tons; zinc and zinc alloys, 400 tons; non-ferrous alloys, 2000 tons; sheet steel and steel strip, 33,000 tons; alloy steel, 4600 tons; carbon steel rods and bars, 7200 tons.

The Order also grants power for total prohibition of auto production upon three months' notice to manufacturers, or to limit any one month's production to one-tenth of the year's total.

40 YEARS AGO

The Australian Military Technical Committee has ordered a specially designed military transport wagon with a 10 hp. motor, though the load the wagon is expected to carry will not exceed that drawn by a 6 hp. engine. The vehicle will have a special low speed so that it will be capable of moving with the troops, and not have to stop for the troops to catch up. It will have four rates of speed, and the lowest of these will be one mile per hour. It will carry benzine sufficient for a twelve-hour run. The width of its track will be the same as that of a field gun, about 5 ft. The motor will be adapted for use as a stationary engine, and will be used, among other purposes, in the working of dynamos for the generating of electricity for searchlights.

From *The Horseless Age*, Aug. 21, 1901.

Contract Awarded For Aqua-Cheetahs

Production of the Aqua-Cheetah, a new type of amphibian reconnaissance car for the Army, is underway in the plant of the Amphibian Car Corp., Buffalo, President Roger W. Hofheins announced after receipt of a $102,000 War Department contract.

The Army intends to use the machines as troop transports, for scouting over rough land and unfordable lakes and rivers, for the evacuation of wounded and for undercover work in capturing bridgeheads where land machines are halted by streams. As produced in Buffalo, the machines will not carry armor or guns.

Packard 1942 Prices

Delivered prices at factory exclusive of transportation charges and state or local taxes have been announced as follows for the 1942 Packards:

SIX

Clipper Special—2000	
Bus. coupe	$1180
Club sedan	1215
Tour. sedan	1250
Clipper Custom—2010	
Club sedan	$1270
Tour. sedan	1305
2020	
Conv. coupe	1385

EIGHT

Clipper Special—2001	
Bus. coupe	$1235
Club sedan	1270
Tour. sedan	1305
Clipper Custom—2011	
Club sedan	$1325
Tour. sedan	1360
2021—127 in. wb.	
Conv. coupe	$1495

SUPER—8-160

Clipper 2003	
Club sedan	$1635
Tour. sedan	1695
2023—127 in. wb.	
Conv. coupe	$1795
2004—138 in. wb.	
Tour sedan	$1905
2005—148 in. wb.	
Tour. limousine	$2175
Tour. sedan	2050
2055—148 in. wb.	
Bus. limousine	$2025
Bus. sedan	1900

SUPER—8-180

Clipper 2006	
Club sedan	$2115
Tour. sedan	2215
Special—2006	
Conv. victoria	$4595
2007—138 in. wb.	
Formal sedan	$3050
Tour. sedan	2465
Cabriolet	4875*
2008—148 in. wb.	
Tour. limousine	$2675
Tour. sedan	2550
LeBaron lim.	5795
LeBaron sed.	5545
Town car	4975*

*F.O.B. New York City.

BOOKS . . . .

PREVENTION OF FATIGUE OF METALS, *by the Staff of the Battelle Memorial Institute. Published by John Wiley & Sons, Inc., New York.*

This handbook on the prevention of failure of metals under repeated stress was prepared for the Bureau of Aeronautics of the Navy and should be a valuable guide to all designers of machinery in which fatigue failures are likely to occur. While a great deal has been published on the subject of fatigue failures, the material is widely scattered and therefore not readily accessible to the average designer.

The nature of the fatigue failure is clearly explained, and numerous photographs of fatigue fractures are reproduced.

SHEET-METAL WORK, INCLUDING METAL SPINNING, *prepared by a staff of technical experts under the direction of E. Molloy. Chemical Publishing Co., Inc., Brooklyn, N. Y.*

This little book, evidently intended for the practical sheet-metal worker, deals with the processes and operations involved in cutting, forming and joining all types of sheet metal.

SPRINGS—A MISCELLANY, *by T. H. Sanders. Published by The Locomotive Publishing Company, Ltd., London, England.*

Mr. Sanders, the author of this book, already had to his credit two previous volumes on the same general subject, one entitled "Laminated Springs," which was published in 1923; the second, "Springs and Suspension," in 1930. The present volume is the first of a two-volume set and deals largely with recent developments in springs and suspensions, though in the first chapter, "Applied Elasticity," applications of the elastic properties of matter are traced back to antiquity.

Victor J. Perini

Victor J. Perini, 51, former manager of the Ford Motor Co.'s rubber plantation in Brazil and of the Ford enterprises at Iron Mountain, Mich., died Aug. 29 at his home in Detroit.

Frank L. Pierce

Frank L. Pierce, secretary of Bravo Products Co., died Sept. 7 at his home in Detroit after a month's illness. He was formerly vice-president of the Federal Motor Truck Co.

Shells Get Liquid Heat Bath

The liquid bath for the preparation of 155 mm shells for hot nosing at the Willys-Overland plant (see illustration AI, Sept. 1, 1941) is a salt bath of a special product knows as Liquid Heat N.D., supplied by E. F. Houghton & Co. This bath is maintained at a temperature of about 1550 deg. F., the shells being partially immersed for seven minutes.

Charles A. Stillman

Charles A. Stillman, vice-president of Goodyear Tire & Rubber Co., Died Sept. 6 at Akron after an illness of several months. He was 68.

6 ALUMINUM, DEFENSE, AND YOU

DEFENSE ISN'T JUST AIRPLANES!

They are first in the hearts of the people and first in the headlines. But Defense is also ten thousand other military necessities, clear across the board, and Alcoa Aluminum goes all the way across with it.

Sheets and shapes and wire; castings and extrusions and forgings, nuts and bolts and tubing and rivets; all these and more forms of Alcoa Aluminum are being chewed up by scores of industries in military applications as varied as the peace-time applications of aluminum used to be.

AND FOR THE SAME REASONS.

Before Defense, one of our advertisements to civilians started off with the headline reproduced at the right. A whole volume of economic and engineering common sense was distilled into those six words. Now, Defense is taking all the aluminum we can make because that headline is a fact.

THIS IS WHAT we were saying, *Before Defense,* to prospective buyers of Diesel engines. A great new industry was feeling its way. Properly, it was weighing the advantages of using Alcoa Aluminum. But Defense had to have those advantages right away, and civilian users of Diesels now have to wait for their aluminum.

THE FIVE WORDS in the headline of this advertisement (B.D.) at the right introduced straight talk about the fundamentals of weight saving with Alcoa Aluminum: vital reasons we thought (and think) that everybody should know. Defense hasn't time to explain that these are precisely its reasons for using aluminum; it just takes all it can get.

LAST MONTH DEFENSE TOOK over 50 million pounds of Alcoa Aluminum, for the simple and clear reason that certain advantages of aluminum are fundamental.

When the emergency is over, Alcoa is going to be talking the same simple language, selling the same fundamentals. And it will have still better techniques and new uses of Alloys of Alcoa Aluminum for you to put to work.

RIGHT NOW, we are in high gear for defense; our foot is on the floor board; we intend to keep it there for the duration.

ALUMINUM COMPANY OF AMERICA

Wiring System Standards

(*Continued from page* 9)

"—at least 10 feet long for each unit. When a wiring harness is supplied with a pair of lamps, one length of wire having an electrical resistance not in excess of 2.97 ohms per 1000 feet at 68° F. or having a cross-sectional area of not less than 3753 circular mils is sufficient to serve both lamps, if proper connectors are used."

In paragraph 11 of this standard, line 5, after the word "Dust" there are to be inserted the words "(where required)." At the beginning of paragraph 16a, a new sentence is to be inserted reading as follows: "Where composite (reflector lense) lighting units are used, the dust test shall not be required."

Ford P & W Engines

(*Continued from page* 42)

Sept. 11, 1940. Now more than 6000 employes are manning the 1000 machines and 8000 jigs and fixtures in what was a cornfield a year ago. The tanks are given a 75-mile test run on a proving ground adjacent to the arsenal before being shipped to the Erie range for final checkup on the 75 mm. gun, the 37 mm. cannon and four other guns, which make this M-3 tank one of the most formidable in the world.

Manufacturing operations also are progressing on the Bofors 40 mm. anti-aircraft cannon which is being made in nine Chrysler plants, with final assembly in the gun arsenal on Lynch Road, Detroit. This operation requires 600,000 sq. ft. of floor space, 200,000 sq. ft. of it under construction. It will use 900 machine tools, of which 400 have been taken from regular automotive assembly lines to speed the job. The gun comprises more than 500 parts, ranging from tiny springs to the 8-foot gun barrels weighing more than 250 pounds. The first two pilot models were completed in June and turned over to the Ordnance Dept.

One of the largest subcontracts to be placed by Ford in its bomber production program was one for $1,500,000 awarded to Motor Products Corp., Detroit, for rear gun turrets. Motor Products also will supply pilot enclosures on the Martin B-26 bomber for Chrysler on a $360,000 subcontract. Other defense work by the company includes $2,000,000 in platform and turret assemblies for tanks manufactured by Chrysler and Pressed Steel Car Co. and $250,000 in miscellaneous Rolls-Royce Merlin engine parts for Packard.

Willys-Overland Motors, Inc., has been granted a $13,000,000 RFC loan to finance production of ¼-ton reconnaissance cars for the Army. The company has orders for 18,600 of these combat vehicles, a recent order for $1,946,717 increasing the total by 2600 units. Allis Chalmers Mfg. Co. has received a Defense Plant Corp. award of $1,973,972 for building and equipping a plant at West Allis, Wis., for production of marine equipment. Wilcox-Rich Division of Eaton Mfg. Co. has received an authorization for $465,235 to build and equip a plant at Saginaw for aircraft engine parts.

Recent national defense orders include $1,239,243 to Autocar Co. for tractor-trucks, $3,390,072 to Buda Co. for tank parts, $234,385 to Fruehauf Trailer Co. for trailers, $1,051,490 to International Harvester Co. for 2½-ton dump trucks, $942,181 to Studebaker Corp. for spare truck parts, $383,874 to Chrysler Corp. for spare truck parts, $1,126,778 to Trailer Co. of America for trailers and dollies, $371,683 to Corbitt Co. for tractor-trucks and 4-ton trailers, $476,793 to Chevrolet for sedans, $611,000 to Guide Lamp Division of General Motors for cartridge cases, $123,495 to Yellow Truck & Coach Mfg. Co. for 1 to 3-ton trucks, $131,962 to Holley Carburetor Co. for carburetors and engine parts, and $102,000 to Amphibian Car Co., Buffalo, for ½-ton trucks.

STEEL

(*Continued from page* 11)

In America

picture, as a whole, which the Institute has outlined. This year's requirements are estimated to exceed 1940 output by about 20 per cent, but capacity has been sufficiently enlarged to take care of this, according to the Institute.

For one reason or another or perhaps for no good reason at all, the problem of the steel industry's adequacy for defense needs has been aggravated by polemics that engender more heat than light. This certainly tests the patience of consumers in the borderline classifications eager to know whether and how much steel will be available for their products, which, although not entitled to an A1 priority rating, are considered by them as economically important, if not essential.

Steel consumers, whether they have defense contracts or not, as well as steel producers are eagerly waiting to see what changes will result from the Supply Priorities and Allocations Board taking over the future flow of steel from mills into fabricating channels. That defense requirements must have priority over all else is by now a well understood rule. Just what regulations will be necessary in order that priorities with a higher rating than others will be accorded the necessary preference on production schedules, also to carry out the board's avowed objective of "stripping civilian economy of non-essentials" and yet keep it in good running order, is the cause of much perplexity.

Recent developments show clearly that they, into whose keeping the national defense program has placed, for the time being, the destinies of the steel market, are determined to apply the rule of common sense above all other considerations to the problems that confront them. So steps have been taken to ease the plight of non-integrated steel producers to make it possible for them to obtain their semi-finished basic material. Another move of this sort was the granting of facilities for obtaining steel to warehouse men, from whom must come much of the steel needed by smaller sub-contractors.

Further tightening of control over prices of non-ferrous metals was attained when maximum levels for cadmium, 90 cents per pound for sticks and 95 cents for anodes, were promulgated by Federal Price Administrator Henderson. A considerable part of the available cadmium supply goes into the manufacture of bearing metals. Priorities control over tungsten has been extended.

Malay tin producers are reported to be worried by fears that the U. S. Government-financed tin smelting plant, now under construction at Texas City, may attract so large a tonnage of concentrates from the Dutch East Indies that Straits tin will lose its popularity in the American market. Prices in Singapore have adjusted themselves to the 52-cents maximum decreed by the Washington authorities.

High-cost copper producers in the Upper Michigan Peninsula have been assured that they will be granted average cost of their product during the first half of 1941 plus 1 cent per pound profit and plus an amount sufficient to permit an increase of $1 per day in the wage of their labor. Arizona mine owners complain of discrimination against their product.

In Britain

thus conserving raw materials and freeing labor for employment in more essential sections of the trade.

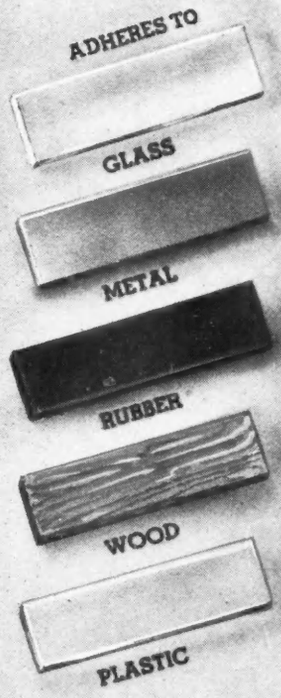
The tin plate section is quoted as an example of how this process of adjustment works. Before the war about half the output of tin plate was exported, but in order to save shipping it was decided not to export tin plate when that would necessitate imports. As a form of packing for innumerable commodities, it has been eliminated for the time being, and as a result of these restrictions tin plate steel plants now are turning out greater quantities of sheet bars for other purposes, also producing billets and manufacturing shell steel.

The immensely geared-up output of airplanes, shells, tanks and a hundred-and-one other kinds of munitions has called not only for increased supplies of the ordinary forms of steel plate and sections, but more especially for increased outputs of alloy steels and armor plate, for the production of which there were only a comparatively small number of plants available before the war. In many of these special products, it is said, capacity has been doubled and in some instances trebled or even quadrupled.

GLASS SEALER

TRANSPARENT

SEALS WINDSHIELDS and WINDOWS



Extreme summer heat, sub-zero cold, driving rains or melting snows play havoc with the metal frames of windshields and windows of automobiles.

Loose weatherstripping, loose glass or cracked glass hold water in contact with metal window frames for long periods. Unless water and air are excluded, corrosion will start and will never stop.

The prevention of water seepage under such conditions was an impossible task until the problem was solved by the Research Department of the Permatex Company.

Permatex Glass Sealer forms a transparent bead or film that immediately sets into position, dries rapidly, adheres strongly and remains tough, pliable and waterproof.

Available in 1 ounce and 5¼ ounce tubes.

PERMATEX COMPANY, INC. Sheepshead Bay, N. Y., U. S. A.

Knudsen Explains

(*Continued from page* 41)

assured from month to month, Mr. Knudsen said that materials are the guide and that it is not possible to work on any shorter basis than that.

"You will assure materials a month ahead?"

"For that month, yes."

The problem was said to be so big that nothing could be done about August, but that on Sept. 15 the automobile industry will be told what can be done for the month.

"At the same time we will revise the schedule for the other three months if we have to," Mr. Knudsen added.

Guarantees are "awfully hard" to make, he said, when dealing with demands that change from day to day.

"All you can do is to negotiate and through cooperation arrive at the best possible result," Mr. Knudsen pointed out.

Reminded that the 20 per cent cut in automobile production was announced in April, to begin in August, but that the August output gain was "approximately 100 per cent," Mr. Knudsen said that was because the starting date was changed last year.

"In other words," he explained, "if they all started on Aug. 1, you will get a certain amount of cars. Last year some of them didn't get any cars. Chrysler and Nash hardly got any. That is the reason."

Mr. Knudsen was asked if the increased production in August means that automobile makers will "feel it a little tighter" in September, October and November, the curtailment for which was set at 235,124 cars for each month.

"That's right," Mr. Knudsen said. "That was all considered in the four-month setup."

Mr. Knudsen said that James Adams and his Automobile Industry Committee will continue to work in the OPM Automobile Section. (Since this interview, Mr. Adams has resigned, so any references made to him will apply to his successor. Ed.)

"You see we (OPM) have absorbed the Civilian Allocations Division," said Mr. Knudsen. "Mr. Adams will use the same committee that we are going to use."

The Automobile Committee, Mr. Knudsen said, will report to him and the Civilian Allocations Section will report for Donald M. Nelson, new Director of Priorities and Executive Director of SPAB, or others whose divisions will have to report through the Automobile Committee. The latter committee, it was stated, will work out the automobile production schedule and W. H. Harrison, advanced to OPM Director of Production, will work from that direction. Mr. Harrison formerly was Deputy Director of Production.

"We will get data from him and work it out with the industry," said Mr. Knudsen. "Mr. Adams will get his figures from Joe Weiner (OPA) and he will work it out with the industry." Mr. Adams will report to Leon Henderson, who is OPA Administrator, member of SPAB and director of the new Division of Civilian Allocations. Continuing the circle, Mr. Henderson will report to Mr. Knudsen.

"You are the boss of OPM and Mr. Henderson follows along?"

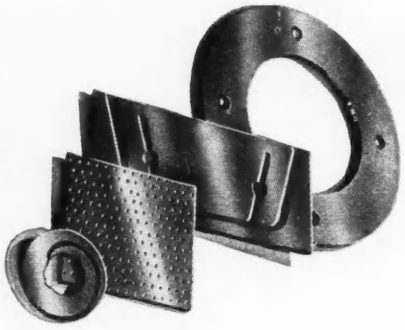
"I can answer that in the affirmative," Mr. Knudsen replied.

The Civilian Supply Division will gather data on automobile production and Mr. Henderson will turn it over to the Automobile Committee. When the material is worked out it will be returned to Mr. Henderson for OPM approval, after which it will go to the Industry Advisory Committee, then to the new Priorities Division before being submitted to SPAB for allocation as the final stage.

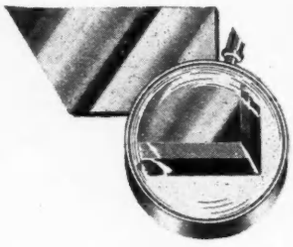
New Synthetic Rubber Plant

Ground was broken last week by the United States Rubber Co., for New England's first great synthetic rubber plant to be constructed in Naugatuck, Conn. The plant will have a capacity of 10,000 tons yearly, and is being built under an agreement of lease between the U. S. Rubber Co. and the Defense Plant Corp.

Pre-Cast Bearing Bronze on Steel PATENTED



New Bearing Metal Adapted to Many Other Uses



PERMANENT BOND

Examine a section of *Pre-Cast Bearing* BRONZE ON STEEL closely and see how permanently the bronze is bonded to the steel.

Write for...

the complete story on *Pre-Cast Bearing* BRONZE ON STEEL... it's FREE.

While *Pre-Cast Bearing* BRONZE ON STEEL was developed primarily for sleeve bushings and bearings, it also fills many other important industrial uses. It is ideal for applications requiring a flat bearing surface such as plates, washers, etc. In applications where the movement is slow or where lubrication is uncertain, it is often advisable to use the graphited bronze type.

Some manufacturers prefer to secure *Pre-Cast Bearing* BRONZE ON STEEL in rolls and do their own stamping and forming. In such cases, we can furnish it in coils up to 400 feet in length. The maximum width of the strip is 5½ inches.

JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

625 S. MILL STREET · NEW CASTLE, PA.

Accurate Timing . . FOR A·C·RESISTANCE WELDERS

More accurate and consistent in its timing within the range of times required for production welders than mechanical timers is this "3C" Bulletin 7744 Weldmaster Electronic Welding Timer.

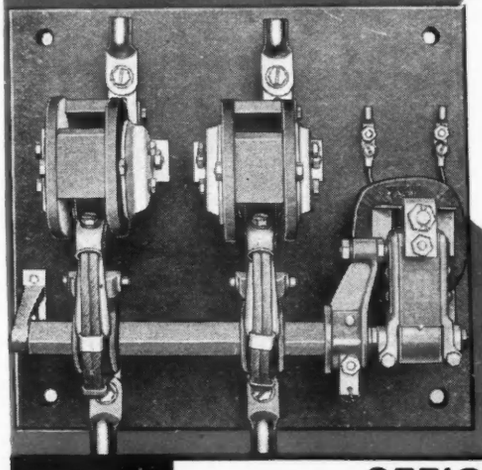
Under varying voltage conditions its time is very well maintained.

Time settings from 2 to 30 cycles based on a 60 cycle circuit, adjustable in 30 steps are provided . . . Indexed dials enable the timer to be reset exactly to any previously used time period . . . There's no guessing nor fumbling in resetting—the dials permit accurate resetting.

One Electronic tube, of low cost, replaceable through radio tube manufacturers' distributors, and one sturdy commercial Relay are used . . . All other devices are not movable, are not affected by frequency of operation, and the entire timer gives exceptionally long, trouble free life.

Fully descriptive Bulletin 7744 is yours for the asking.

"3C" Bulletin 7744 WELDMASTER Electronic Timer for A.C. Resistance Welders.



TO THE LEFT is shown a "3C" Bulletin 7740 A. C. Magnetic High Speed Welding Contactor . . . It is specially designed to meet extreme, exacting service conditions in resistance welding applications.

It features a light weight moving armature, high speed closing with minimum impact, spring as well as gravity opened, large size duplicate, hard drawn copper contact tips . . . adjustable contact spring pressure, and adjustable contact gap. Write for fully descriptive Bulletin 7740.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1941	1940	1941	1940	1941	1940
January	423,223	375,476	100,835	74,016	524,058	449,492
February	405,160	350,535	104,172	71,690	509,332	422,225
March	422,289	364,947	111,587	75,285	533,876	440,232
April	387,070	375,626	102,784	76,807	489,854	452,433
May	427,538	338,353	117,817	74,139	545,355	412,492
June	427,521	294,779	118,757	67,787	546,278	362,566
July	347,597	172,166	121,160	74,005	468,757	246,171
Total, 7 Months	2,840,398	2,271,882	777,112	513,729	3,617,510	2,785,611
Year Total	.....	3,802,454	.....	889,884	.....	4,692,338

DANLY KWIK-KLAMPS

TOGGLE CLAMPS FOR QUICK, POSITIVE CLAMPING IN ANY POSITION WITH

STANDARD HALF TURN

OR STRAIGHT CLAMPING BAR

WRITE YOUR DANLY BRANCH

DANLY MACHINE SPECIALTIES, INC.

2100 So. 52nd Ave. • Chicago, Ill.

Milwaukee, Wis. Dayton, Ohio Rochester, N. Y.
Long Island City, N. Y. Detroit, Mich. Cleveland, Ohio
Philadelphia, Penna.

Ducommun Metals & Supply Company, Los Angeles; San Francisco

DANLY DIE SETS and DIE MAKERS' SUPPLIES

Sunoco All-Purpose Gear Lubricant

Sun Oil Company has placed on the market a new all-purpose gear lubricant. It is said to be a blend of highly refined mineral oil with a chemical additive, and is claimed to possess the following advantages: It enables gears to carry heavy loads continuously without injury, and to withstand shock loads. Unlike certain hypoid gear lubricants, it does not tend to cause corrosion, and therefore can be used in the transmission as well as in the axle. It has high resistance to deterioration in service, and it has adequate body at high temperatures, yet flows readily at low temperatures. Sunoco hypoid gear lubricant is being discontinued, its place being taken by Sunoco All-Purpose lubricant of S.A.E. 90 viscosity number. The new lubricant can be used also in place of Transep of similar S.A.E. number, but the Transep grade will not be discontinued as it is said to be ideal for rear axles that do not require the special hypoid lubricant. Transep S.A.E. 80 and S.A.E. 140, moreover, have certain definite applications, and the All-Purpose grade will not be made in these viscosity numbers for the present.

Chrysler Motor Parts Expands

Chrysler Motor Parts Corp. is expanding its southern parts distributing center, in Atlanta, Ga., where it will occupy larger quarters about Jan. 1.

Messerschmitt 109F

(*Continued from page* 23)

electrical generator.

The following specifications are listed for the Me-109-F1-Series 2 fighter:

DIMENSIONS

Span	33 ft.
Length	29 ft. 8 in.
Height (to mid point of spinner, tail down)	7 ft. 1 in.
Track	7 ft.
Wing chord at root	7 ft. 4 in.
Wing chord at tip (at starting point of rounded section of wings)	4 ft. 1 in.
Wing thickness at root	1 ft.
Wing area (gross)	186 sq. ft.
Wing area (net)	164 sq. ft.
Aspect ratio	5.85 to 1
Dihedral	6.6 degrees
Span of stabilizer	10 ft.

WEIGHTS (Estimated)

Empty	4740 lb.
Loaded	6000 lb.
Wing loading	36.6 lb. per sq. ft.

PERFORMANCE (Estimated)

Maximum speed	380 m.p.h. at 21,000 ft.
Range	370 miles at 307 m.p.h. in. 1¼ hr. or 600 miles at 262 m.p.h. in 2⅓ hr.
Service ceiling	40,000 ft.

Laboratory Tests Guard Muskegon Quality

(*Continued from page* 31)

Perhaps the best way to visualize the operation of the machine shop is to follow the steps in the machining of several different types of rings. Consider, first, the production of the 3½ x 3/16 in. drilled oil rings, an M-P-R specialty. The sequence of operations is as follows:

Grind outside diameter, maintaining a tolerance of 0.002 in. or radial wall thickness, on a Landis grinder.
Semi-finish side grind, maintaining a tolerance of 0.001 in., on a Besly grinder.
Finish side grind to tolerances of 0.0005 in. for size and 0.0002 in. for flatness.
Wire brush outside diameter.
Rough mill gap on an Automatic rough mill.
Rough turn outside diameter and groove annular channel on a Fay Automatic.
Mill ends of ring to predetermined gap specifications.
Drill 48 No. 47 (0.785 in.) oil drain holes on a Kingsbury drill.
Wire brush inside diameter.
Finish turn outside diameter on a Rockford lathe.
Final inspection.
Check land parallelism.
Barrel gauge for gap opening.
Check width, flatness, parallelism, and radial wall thickness.
Visual inspection for foundry and machining defects.
Check outside diameter light.

Next consider the machining of a 3½ x ⅛ in. compression ring, having the following sequence of operations:

Grind outside diameter maintaining a tolerance of 0.002 in. on radial wall thickness, on a Landis grinder.
Semi-finish side grind maintaining a tolerance of 0.001 in., on a Besly grinder.
Finish side grind to tolerances of 0.005 in. for size and 0.0002 in. for flatness.
Wire brush outside diameter and inside diameter.
Rough inspect and line up identification mark.
Rough mill gap on Automatic rough mill.
Rough turn outside diameter on a Chard lathe.
Mill ends of ring to predetermined gap specification.
Finish turn and taper outside diameter on a Chard lathe.
Check taper on face of ring—final inspection.
Barrel gage for gap opening.
Check width, flatness, wall thickness, and parallelism.
Visual inspection for foundry and machining defects.
Check for outside diameter light.

As a commentary on the variety of rings produced here, also to intimate the degree of flexibility of the manufacturing set-up, it is of interest to note that they make 156 sizes (including oversizes for replacement) for one large passenger car builder alone. The machine shop is equipped to handle on the average about 300,000 rings per day.

Machine shop management has to be on the alert to take advantage of all of the latest production equipment and techniques. In fact, that is our test for the progressiveness of a manufacturing organization. We were impressed with the fact that the company has been experimenting with and utilizing Carboloy tools since 1929 when these tool tips were first made available. At the moment, they are using Carboloy-tipped tools for all rough turning and facing operations; and rough turning and grooving on the new Fay automatic lathes.

So far as the details of machining operations are concerned, we believe that the routings given above, together with some interesting illustrations, will enable the reader to visualize the general character of the work. It may be noted at this point that rings are slotted one at a time and that, in general, the management is inclined to single operations wherever feasible as contrasted with the customary procedure of handling rings in stacks. The reason for this is that many operations are so exacting as to tolerances that quality can best be maintained when handling one ring at a time.

Perhaps the most modern equipment found in this plant is the battery of two 8-in. Fay automatic lathes of the latest type used for rough turning and grooving rings in one setting. The front slide, fitted with four Carboloy-tipped tools takes the rough turning of the stack of rings held in a special mandrel; the back slide, fitted with 36 tools, takes the grooving. The entire operation is fully automatic.

Quality control, as mentioned before, is a basic consideration, assuring perfection of the product dimensionally and in its physical properties. As one means to this end, there is a floor inspection in every machine shop department. This is a sampling inspection, based on a 20 per cent random checking. Final inspection is exacting and is rather interesting in its execution what with the new set-up recently placed in operation. Since the last operation in the machine shop is that of boring, the final inspection has been placed adjacent to the boring machines, the work being pushed onto gravity roller conveyors through windows communicating with the inspection benches.

As the rings move down the line between the small inspection benches, they are taken off the conveyor, inspected visually, then placed on a gravity roller conveyor on the outside line and moved on through the other inspection stages. The principal inspection operations have been listed on the routings mentioned earlier. It may be noted that the light test is a 20 per cent sampling procedure. The light testing equipment is rather unique, one of its principal features being the use of a green, bent Neon tube, light source which is said to be restful for seeing and shows up imperfections with a greater degree of precision than does the conventional white light source.

Finally, the visitor will be impressed with the new plating department recently added to provide the productivity demanded for national defense. This department is equipped with the latest types of tank plating equipment and automatic controls for the plating of copper, tin, cadmium, and the special Graphitox coating supplied to certain customers. In general, the tin plating is on a 12-minute cycle; cadmium, 10 minutes. However, they have one heavy duty ring for a diesel engine which requires a special tin coating about 0.004 in. in thickness. This is done in a special plating tank, requires an immersion time of 5 hours.

In plating, the standard equipment rings are coated only on the outside surface whereas the replacement rings supplied to the manufacturers are coated all over. To this end, the equipment rings are stacked tightly on an arbor so as to present only the outer surface to the plating solution. The other rings are mounted individually, in "trees," on special racks so as to expose the entire surface.

1942 Studebakers

(*Continued from page* 25)

prevents operation of the starting motor unless the shift lever is in the neutral position.

The Champion is equipped with a six-cylinder engine of 3-in. bore and 4-in. stroke (170 cu. in. displacement) which is rated 80 hp. at 4000 r.p.m. A vibration damper has been added to the crankshaft. Overdrive is available on all Champion models. The gear ratio is 4.1 with the conventional transmission and 4.56 with the overdrive, which makes the overall ratio with the latter 3.29. Tires on Champion models are 16x5.50.

The Commander is equipped with a six-cylinder L-head engine of 3 5/16-in. bore and 4⅜-in. stroke (226 cu. in. displacement) which delivers 94 hp. at 3600 r.p.m., with its standard compression ratio of 6.5 The President has an eight-cylinder L-head engine of 3 1/16-in. bore and 4¼ in. stroke (250 cu. in. displacement) developing 117 hp. at 4000 r.p.m. with a compression ratio of 6.5.

MEN and MACHINES

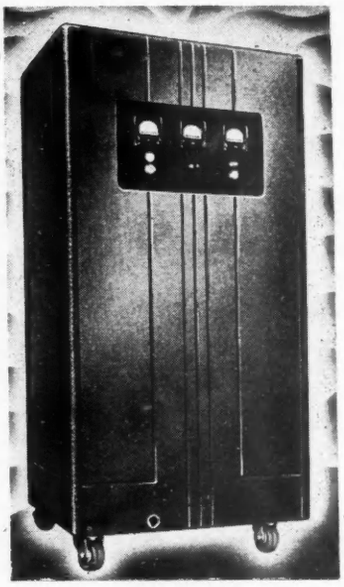
(*Continued from page 37*)

hold a gun barrel 56 in. long and of 0.8 in. diameter during the honing operation.

TWO new testing machines have been added to the line of physical testing equipment of the Baldwin Southwark Division, Baldwin Locomotive Works, Eddystone, Pa. Designated as Southwark - Tate - Emery models 20-35 and 60-35, the two units are similar, except as to size, the former having a capacity of 20,000 and the latter of 60,000 lb. The former is designed especially for testing plastics, while the latter is intended for routine testing of metals. Accuracy is guaranteed to within 0.75 per cent of the load or 0.15 per cent of the range, whichever is larger.

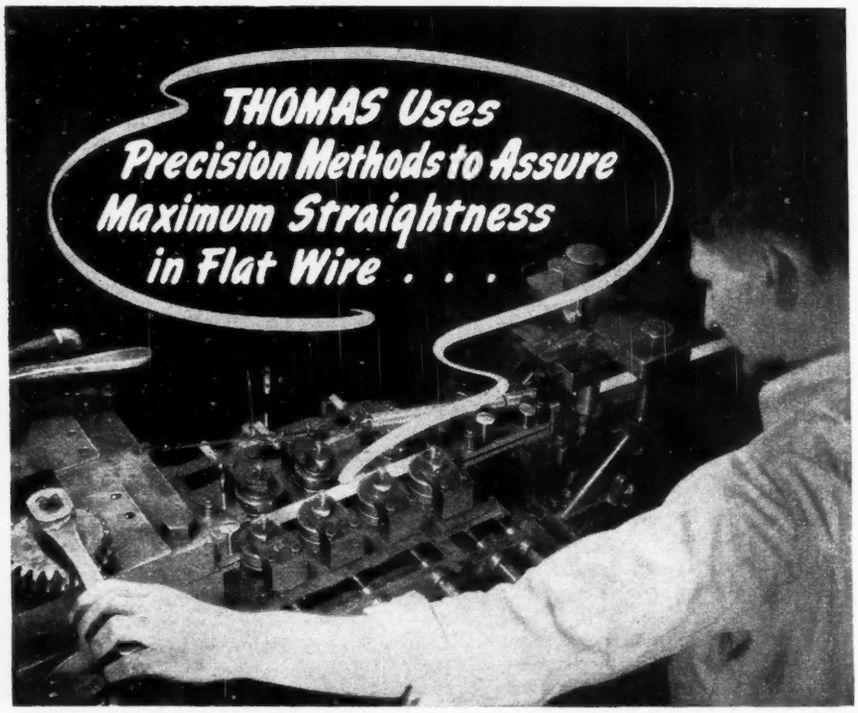
The machines employ the lapped-ram principle for load application. The operating ram is at the top and the straining yoke is carried in this ram on a ball-ended strut. Central and lower gripping heads are adjustable for convenience in the positioning of the specimen. The load-indicating unit, which provides two or three dial ranges, is similar to that on the company's larger capsule-type machines.

INDUCTION Heating Corp., which has just moved to larger quarters at 389 Lafayette St., New York, calls attention to its new Thermionic Generator for heating metallic parts for surface-hardening, brazing, melting, annealing, forging, soldering and heat-treating. In heating units of this type, high-frequency current (up to 500,000 cycles per sec.) is sent through a coil composed of one or more turns of copper tubing, which is shaped to closely follow the contour of the part to be heated, without touching it. When ferrous-metal parts are placed within the magnetic field thus created, heat is generated in them by both hysteresis and eddy currents, and the parts may be raised to the critical temperature of the material, at which it loses its magnetic properties and no further heating by hysteresis is possible. With non-ferrous metals heat is produced by eddy currents alone. The Thermionic Generator requires 33 by 37 in. floor space and is 66 in. high.



Thermionic generator

A 48 by 96-in. surface plate, cast in semi-steel and finished plane within 0.005 in., is being offered by South Bend Tool & Die Co., South Bend, Ind. Two sizes of adjustable blocks or legs (10 in. and 12 in.) make possible working surface heights ranging between 29 and 33 in. The blocks support 1½-in. screws with circular caps recessed to receive projecting sup-



PRECISION MADE

Thomas Strip

COLD ROLLED STRIP STEEL

Always Laboratory Approved

EXTRA QUALITY in Thomastrip is obtained by supplementing many customary mill operations with various special processes. The illustrated machine, used after rolling operations, straightens, flattens, and assures a minimum of camber in Thomas flat wire. Special annealing equipment enables Thomas to meet specifications accurately and maintain uniform temper. Thomas has facilities to furnish long-length coils which eliminate frequent threading into forming machines and hence saves valuable time. Since special attention is paid to quality of high rank, as well as small but important details, Thomas customers can make better finished parts with faster production.

THE THOMAS STEEL CO., WARREN, OHIO

SPECIALIZED PRODUCERS OF COLD ROLLED STRIP STEEL

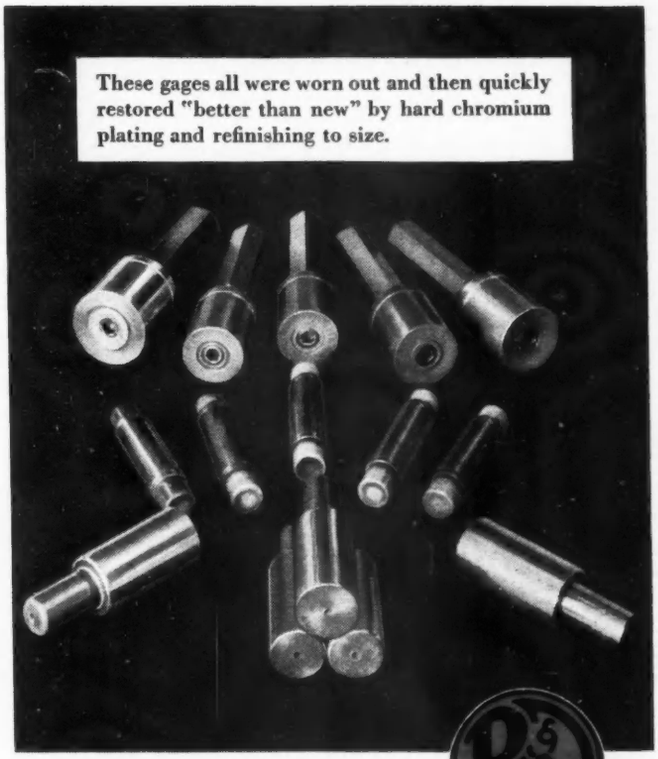
NO NEWS TO P&W CUSTOMERS

The only "new" thing about salvaging worn gages by hard chromium plating is its special significance in speeding the defense program. Recent headlines have made it appear new. We started doing it over ten years ago . . . pioneered it in fact . . . and have been at it ever since. As you might expect, we are well equipped and well experienced.

Today when a gage becomes dangerously worn you don't throw it away. You send it to us for hard plating. We build up the necessary amount of chromium directly on the steel, and then refinish to size. We have saved our customers many hours and dollars by salvaging worn gages, as well as many other tools and machine parts. That means something now when every minute counts.

Never confuse "flash chromium plating" with hard plate. The first is done for appearance or surface protection, and is extremely thin. Usually it is put on over a thin plating of copper and nickel and simply polished. Hard plate goes right on steel and is built up heavily as required. It is finished to size afterwards.

Perhaps our facilities can help you maintain the pace by putting worn gages or parts back into the running. We will be glad to cooperate.

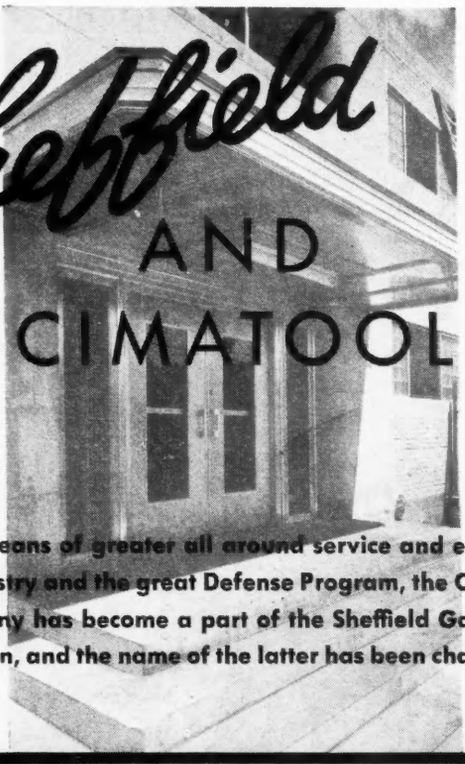


These gages all were worn out and then quickly restored "better than new" by hard chromium plating and refinishing to size.

PRATT & WHITNEY

Division **Niles-Bement-Pond Company · West Hartford, Connecticut, U. S. A.**

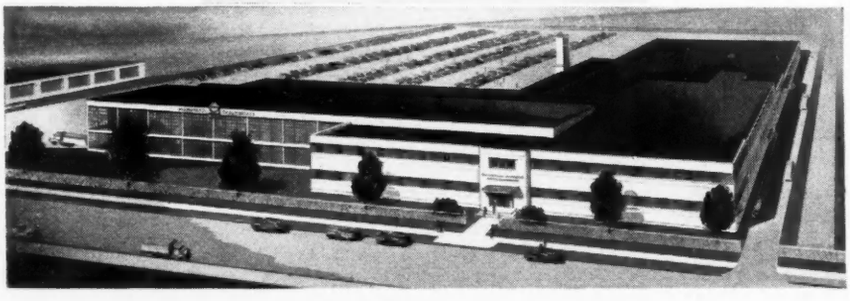
Sheffield
AND
THE CIMATOOL CO.



As a means of greater all around service and efficiency to industry and the great Defense Program, the Cimatool Company has become a part of the Sheffield Gage Corporation, and the name of the latter has been changed to

THE SHEFFIELD CORPORATION
with four principal divisions—the Gage Division, the Machine Tool Division, the Special Tool and Die Division and the Engineering Service Division.

With the new plant addition, more than two million dollars worth of production facilities are now combined in the greatest operations of the organization's history, operations that embrace precision gages, machine tools, dies, tooling, jigs and fixtures.
America's finest inland gage plant invites your inquiries on all precision products.

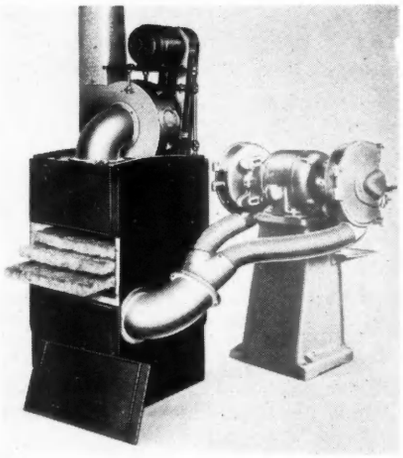


THE SHEFFIELD CORPORATION
Gage Division · DAYTON, OHIO, U.S.A.
SHEFFIELD MASTER GAGEMAKERS

port points on the under side of the plate. A 12-pitch thread provides fine adjustment to compensate for floor irregularities, etc. Five of these blocks go with each surface plate. The ribbed underside gives maximum rigidity for a plate of the weight of this one—3 tons.

H. O. SWOBODA, INC., New Brighton, Pa., is now in production on a new line of Falcon electric box-type and muffle-type furnaces. These furnaces are adapted for testing metal samples, melting glass samples, burning refractories, oxidation determinations, testing vitreous enamels, heating high-speed and similar steels in tool rooms, etc. They are arranged for either floor or bench mounting and are equipped with heavy alloy heating elements to permit operation at temperatures up to 2300 deg. Fahr. The Type BRP has a chamber 9 in. high, 12 in. wide and 36 in. deep. It will take 16 kw. and is suitable for 2000 deg. maximum operating temperature. Automatic temperature controls are mounted on the side of the furnace, completely wired for connection to the power supply. The door mechanism is operated by treadle.

A NEW exhauster and filter manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio, is intended for use with grinding and buffing machines, etc. The dust-laden air enters a cyclone collector which removes the coarser particles and then passes through impingement-type filters which

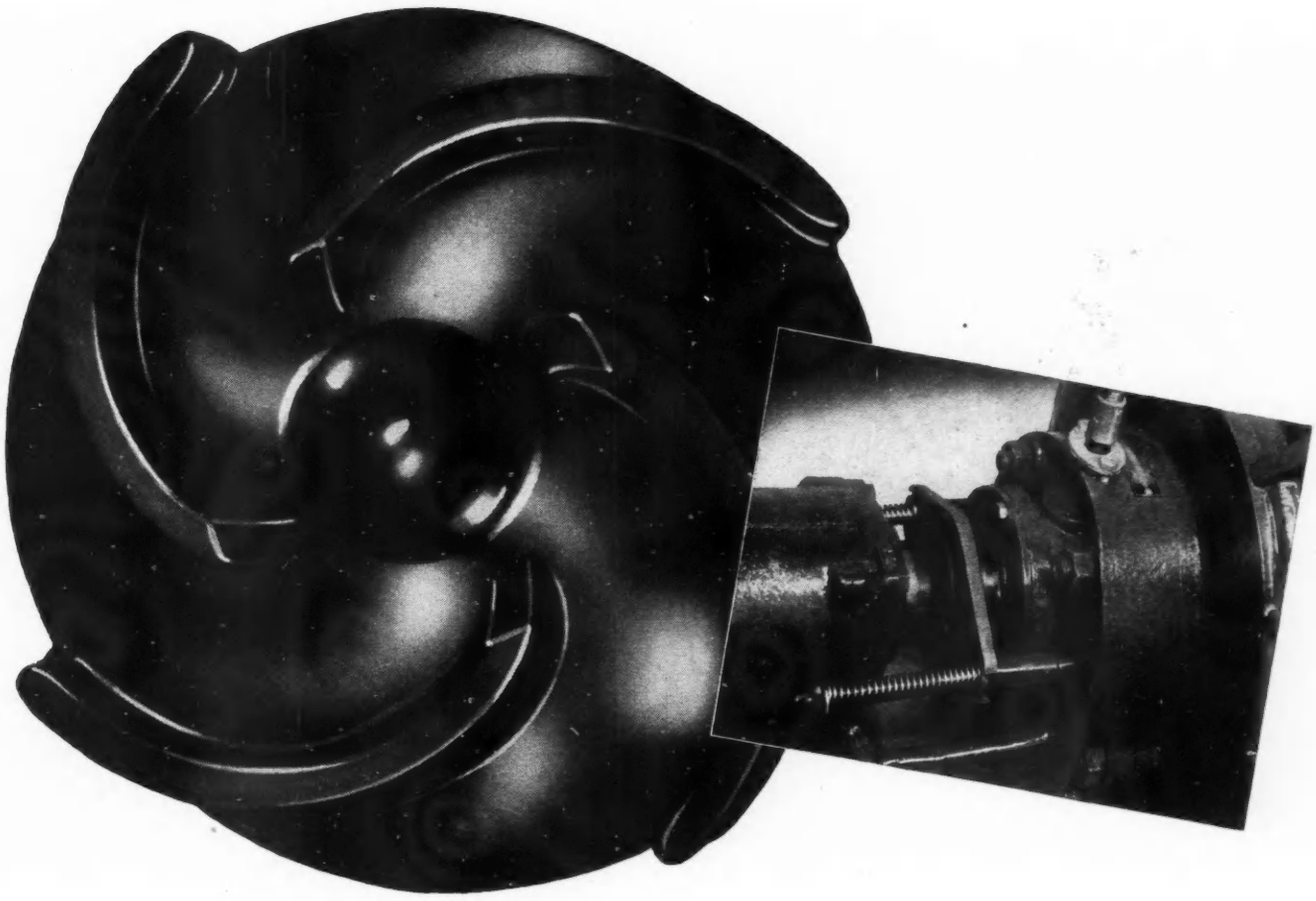


Hisey combination exhauster and filter

remove the finer particles. The motor is mounted on the outside to insure cool operation and a clean atmosphere. A handy clean-out is provided for the larger particles, and the filters are readily removable for cleaning by shaking. This machine is made in four sizes.

A NEW white tracing cloth, Whitex, just announced by the Frederick Post Co., Chicago, is said to give blue

(*Turn to page* 61, *please*)



Cure for Pump Acidosis!

PUMPING ACIDS from points A to B in a plant is the sort of mean problem that turns engineers' hair gray. Yet this endless fight against corrosion is all part of the day's work to the technicians of Oliver United Filters Inc.

Here you see their latest acid-tamer which handles a capacity of 450 gallons of acid per minute with the greatest of ease. And what is the secret of this otherwise familiar looking pump? Inside, if you could see the impeller, you would find that Durez plastics scored another triumph. By combining parts of a special, extremely high acid-resistant Durez molding compound with parts of their own acid-resistant "Olivite"...Oliver United engineers found an effective solution to corrosion. Their exhausting tests have shown that the molded Durez impeller and other parts are greatly superior for many purposes.

This chemically-inert quality of Durez plastics offers an opportunity to automotive and aviation engineers for improving pump design. Pump parts of molded Durez are impervious to the corrosive electrolytic action common to liquid cooling systems. Furthermore, Durez is immune to rust, oil or heat. Longer life and trouble-free operation are assets that Durez can give to any pump!

But why stop at a pump? Plastics, being man-made, have a versatility no other structural material can duplicate. Beauty...physical and dielectric strength...corrosion-resistance . . . precision . . . mass-production economies—all these are at your finger-tips when you design and build with Durez plastics.

Are you planning now for the future? Durez chemists and engineers will be glad to make available to you their experience and knowledge of plastics.

DUREZ PLASTICS & CHEMICALS, INC.

119 Walck Road, North Tonawanda, N. Y.

Durez Phenolic Resins are used for:

MOLDING COMPOUNDS — LAMINATING VARNISHES
INSULATING VARNISHES — INDUSTRIAL FINISHES
ADHESIVES — IMPREGNATING SOLUTIONS
PROTECTIVE COATINGS

DUREZ PLASTICS & CHEMICALS, INC.

PLASTICS THAT FIT THE JOB

The Plant Superintendent Says...

"Our production curve has taken a definite upswing since we adopted Mallory Standardized Welding Tips."

MALLORY
Resistance
Welding Data Book

Your technical library is incomplete if it does not include this comprehensive reference prepared by the outstanding technicians in the field of resistance welding. Write for your copy today.

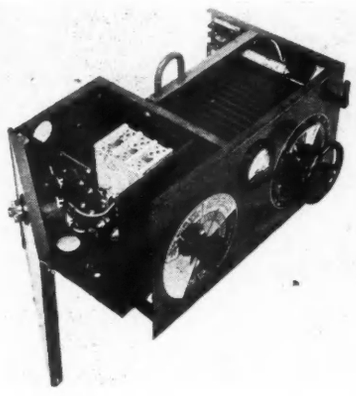
Reduce the "down time" necessary for redressing and replacement to a minimum. Eliminate the "down time" caused by waiting for the completion of special orders . . . and any production curve is bound to take an upswing. And that is exactly what has been accomplished through Mallory's program of standardization of welding electrodes.

The experience gained through limitless field practice has clearly defined every requirement for greater welding electrode efficiency. Mallory Welding Electrodes are definitely better because of it. Add to this Mallory's tremendous and continuing investment in research and collaboration with welding machine manufacturers and you have the reasons behind the superiority of Mallory Welding Electrodes. Don't forego their advantages. Get all the details now.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA *Cable Address*—**PELMALLO**

prints from pencil tracings similar in sharpness to those usually obtained from ink tracings. The tracing cloth is said to be tough and durable and not to discolor with age. It has a glossy "stay-clean" back, and is unusually transparent. Whitex is said to erase quickly and cleanly with art gum or a soft eraser, and erasures do not show on the blue print.

A NEW welder control box, Type G, is announced by the Lincoln Electric Co., Cleveland, Ohio. It is designed to prevent accidental contact with live parts, permit wiring with flexible or rigid conduit or rubber-covered multiple conductor cable, increase accessibility, and eliminate dangers from unintentional loosening of the lifting hook.

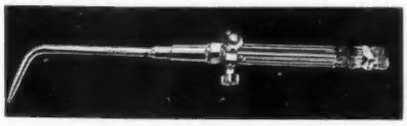


Lincoln Type G welder control box

There are separate compartments for a.c. circuits (including the push button) and d.c. terminals. Both compartments have a snap catch which holds the door in the closed position.

THE Pyle-National Company, Chicago, announces a fixture-hanger Pylet specially designed for the installation of combination mercury-vapor and incandescent lamp fixtures. The U series fixture hanger pylets provide for permanent mounting of the transformer required for mercury vapor lamps above the messenger or span wire. The weight of the transformer is carried by the support rod attached to the ceiling structure. With this method of installation, only the lighting fixtures are below the messenger or support wire and may be removed independently for maintenance.

A LINE of welding torches for use in aircraft and automobile production, sheet metal and tube welding, has been announced by the National Cylinder Gas Co., Chicago. Long-bend and short-bend swaged tips of pure copper, with brass protectors to prevent damage to the tip threads, are available in the following (drill) sizes: 76, 72, 68, 62, 59, 55, 53, and 51. Each tip covers a relatively wide range of heat output,



Rego aircraft welding torch

and the flame may be varied from short to long-pointed. Among advantages claimed for Rego welding torches are exceptional balance for precision work, light weight (7 oz.), convenient front-end valve wheels for one-hand flame adjustment, compactness, and a fast, penetrating flame.

Aircraft Committee Board

New members of the board of the recently organized National Aircraft Standards Committee are William M. Smith (Bell Aircraft), national chairman; J. T. Thompson (Glenn L. Martin), chairman, eastern division; F. M. Salisbury (Douglas), chairman, western division; Com. R. D. McCart (Brewster), eastern division executive representative; Newton S. Huston (North American), western division executive representative; J. T. Gray (Aeronautical Chamber of Commerce), secretary. Twenty-seven aircraft manufacturers are organization members.

"I WANT THE BEST POSSIBLE JOB— I MUST HAVE A GOOD OIL!!"

"THAT'S WHY I CALLED THE CITIES SERVICE LUBRICATION MAN IN" SAYS A. E. DAVEY, PRESIDENT OF ALLOY STEEL GEAR AND PINION COMPANY OF CHICAGO.

"I'm doing a job here that must be perfect when it leaves the shop. The people who get the gears are plenty critical." Mr. Davey says further, "I don't know everything about oil. That is why I called in the Cities Service Lubrication man. I expect him to work with my men to see that they get the oil best suited for the job."

A. E. Davey

Much work in this shop must meet rigid government inspection. All Gleason, Fellows Gear Shapers, Lee Bradner and Brown & Sharpe machines, are operated with Cities Service Lubricants. You, too, will find these high-quality fluids capable of doing the kind of work your customers want.

Call us in for consultation — there is no charge for the service. Write us on your letterhead or mail the coupon for a copy of our booklet, "Metal Cutting Lubrication."

CITIES SERVICE Cutting Oils "SERVICE PROVED"

FREE Just clip and mail

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 1329, New York

Please send me a copy of your booklet, "Metal Cutting Lubrication."

Name.....

Firm Name.....

Address.....

City.....State.....

Automotive Materials

(*Continued from page* 39)

on the above results, except in respect to dimensional change. Known slight differences in analysis and possible differences in casting practice will probably explain this discrepancy when a complete story is available. The New Jersey Zinc Co.'s results indicate some difference between alloy XXV and the 1.5 per cent aluminum alloy. They further report that to retain as favorable a comparison with the specification alloy as above, a low-aluminum substitute for alloy XXIII (4 per cent Al, 0.03 Mg) must contain at least 2.0 per cent aluminum.

Varying reports have been heard concerning the experiences of die casters attempting to use these alloys. Some difficulties have been encountered due to the difference in solidification shrinkage characteristics and greater hot shortness of the lower aluminum alloys. In some instances, these difficulties have been overcome by increasing the aluminum content from 1.5 to 2 per cent. It would thus seem that whereas a large number of castings can be made with the low aluminum-content alloys because of the difficulties enumerated, some castings cannot be successfully produced from them.

Cashew Nut-Shell Liquid

ARRANGEMENTS are being made for the importation from Brazil of cashew nut-shell liquid—an oil of considerable industrial importance. Dr. Mortimer T. Harvey, technical director of the Harvel Corp., a research subsidiary of the Irvington Varnish & Insulator Co., and William F. Hoffman, vice president of the parent organization, left for Rio de Janeiro recently with that object in view. Cashew nut shell oil resides in a cellular structure between the inner and outer shells of the nut. It is a natural phenol having excellent electrical properties, and it is made into numerous synthetic resins, among the uses of which are as a cold-setting phenol-aldehyde cement for cable sealing, as the base of a heat-hardenable polymerizing insulating varnish and, as a friction dust used in automobile brake linings. The previous source of supply of cashew nut shell oil was Mangalore, India, but on account of the shortage of shipping facilities, a source nearer home is desired. Irvington Varnish Insulator Co. is said to use 85,000 gallons of the oil annually.

Conductive Flooring

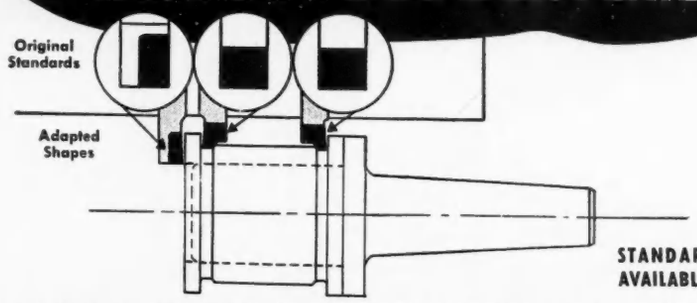
A CONDUCTIVE rubber flooring is being produced by Goodyear Tire & Rubber Company for use in munitions plants where the floorings must be a conductor of static electricity and at the same time withstand the chemical action of ether, alcohol, nitric, sulfuric or hydrochloric acid, in addition to explosives in powder gaseous or liquid form. This new black-colored flooring is made in four thicknesses, with smooth plate finish that may be cleaned with steam clear lukewarm water, or water to which ammonia has been added. Goodyear also furnishes static-conducting, pressed-on solid, industrial pneumatic and wheelbarrow pneumatic tires for use in plants where precautions against uncontrolled electrical discharges are necessary.

Truck Production by Capacity

(U. S. and Canada)

	SEVEN MONTHS		
	Units		Per Cent of Total
	1941	1940	1941
1½ Tons and less	645,043	458,559	83.01
2 to 3 Tons	92,218	31,743	11.87
3½ Tons and over	15,272	8,911	1.97
Special and buses	9,582	4,202	1.23
Station Wagons	14,926	10,304	1.92
Total	777,041	513,729	100.00

FEDERAL-MOGUL
Saves 6 to 8 Weeks on
CARBIDE TOOL DELIVERIES!



QUICKLY ADAPTS CARBOLOY STANDARD TOOLS TO FORM CUTTING . . .

To eliminate weeks of waiting for special form tools required to machine their bushings and bearings, Federal-Mogul Corporation—well known Detroit manufacturers, evolved this simple, fast method:

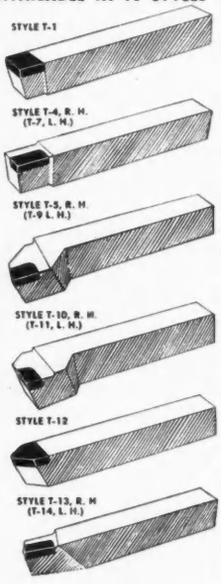
Instead of ordering form tools, Federal-Mogul Corp. orders Carboloy STANDARD-STOCK tools and quickly adapts them to meet their special requirements.

The example illustrated above is typical. The tool at left is adapted from a Carboloy Standard Style 4. Federal-Mogul orders this tool from stock and grinds the slight offset required. The two tools at right are adapted from Carboloy Standard Style 1. Federal-Mogul orders these from stock and grinds the ends to the form shown. All adaptations are made in the Federal-Mogul tool room.

In setting up this "help yourself" plan, Federal-Mogul last Fall checked all of their form tool drawings against Carboloy standard tool specifications. All standard tools that could be readily adapted to their special form requirements were so identified. Standard tools were then stocked and made immediately available for current demands.

Through this simple procedure form tools get on the job FAST—at Federal-Mogul. May we help you get the same fast results? Send for Catalog GT-129.

STANDARD TOOLS ARE AVAILABLE IN 10 STYLES



CARBOLOY COMPANY, INC.
11151 E. 8 Mile Blvd., Detroit, Michigan

Chicago • Cleveland • Los Angeles • Newark • Pittsburgh • Philadelphia • Worcester, Mass.

Representative: F. Robbins, Portland, Ore.—Seattle, Wash.
CANADIAN DISTRIBUTOR: Canadian General Electric Co., Ltd., Toronto, Canada.

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